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Reinforcing Wooden Box Cars

The wooden box car that is too good to scrap and yet not strong enough to meet modern service conditions, forms a serious car department problem. In many cases the problem has been successfully solved by rebuilding the cars and adding steel underframes. While the life of such cars can be lengthened and their capacity increased by thus rebuilding them, it is always an expensive way out of the difficulty and is not always justified. The method employed in reinforcing wooden box cars on the Canadian Pacific, which is described elsewhere in this issue, is of special interest because of its simplicity and cheapness, and because the work can be done at almost any car repair yard. In strengthening the ends of these cars no expense is involved in tearing out the old material. Even if the old end posts are cracked they and the old lining are left in place and the reinforcement placed over them. The large number of cars which have been strengthened in this way have justified the application of this end reinforcement and the Z-bar center sills, as the repairs afterward found necessary are no more extensive than if an entire steel underframe had been employed.

The Training of Railway Men

In the address presented by George M. Basford at the January meeting of the New England Railroad Club, a portion of which is reprinted in this issue, the railway men of this country received a warning. Will the warning be heeded, or when skilled men are needed, will the practice be continued of "Making them overnight from anything with two hands that comes along?" The type of man that the railway conditions of today demand cannot be developed overnight, nor in a few days or a few weeks. The one solution of this problem is careful selection and systematic training over a period of years; in a word, apprenticeship.

A vital point in the training of apprentices, on which emphasis was laid in this paper, is the keeping of the boys on the road after their apprenticeship is completed. In dealing with this Mr. Basford says: "Is your organization qualified to receive and retain apprentices when through their time? If not you have a great work to do before you begin to talk about training young men for railroad service. Do you encourage capable young men, and do you have automatic means whereby able men will reveal their qualifications for promotion? Do you promote men and thereby encourage your subordinates or do you import strangers when you have good places to fill? If you cannot answer these questions look up the plan for studying and recording the characteristics of men, which was so successfully introduced on the Lake Shore & Michigan Southern (see American Engineer, December, 1908,) about five years ago by LeGrand Parish. Does your president give it out as a basic principle of organization that every officer on the road must train and otherwise educate his own successor? Progressive promotion presents a problem, but until it is solved or partially solved, it is fruitless to consider recruiting systems. The best possible recruiting and training methods will fail if recruits, however well trained, are brought up against continual discouragement."

In order to keep apprentices on the payroll after graduation they should be given journeymen's wages. That this is realized on the New York Central is indicated by the fact that 84 per cent of the apprentices who graduated in 1912 and 86 per cent of those who graduated in 1913 were given journeymen's rates and remained in the service of the company.

In discussing Mr. Basford's paper, F. W. Thomas, supervisor of apprentices of the Atchison, Topeka & Santa Fe, said: "While authority was given us nearly seven years ago

to experiment with an apprenticeship scheme for two or three years, it has long since passed the experimental stage and the Santa Fe would no more think of abolishing its apprentice system than it would of abolishing its power houses and tool rooms. Everything put forth by Mr. Basford in this paper, and even more, has been proven to be more than true. During this time we have filled a number of our shops with bright, aggressive, active, ambitious young men, thoroughly skilled in their trades, and 70 per cent of all the apprentices graduated during the past seven years are still in service, and over 10 per cent have been given some official position. While formerly we had to employ from two to three thousand men annually to keep our shops going, it is the prediction now that within two years from this date it will not be necessary for the road to go outside to employ any skilled mechanics. This road does not consider the educating and training of the apprentices in the shop as an expense, but considers it an investment."

Wherever apprenticeship has been given a fair trial the success has been immediate, and the results that are being realized by the comparatively few roads that have installed such a system prove beyond question that apprenticeship is no longer an experiment.

Pennsylvania Atlantic Type Locomotive

In the last analysis to bring a heavy passenger train to high speed and to maintain the speed, means simply boiler capacity in the locomotive. This, of course, assumes that the cylinder passages are suitably designed to allow the locomotive to run at high speed at a fairly long cut off. Therefore there is no particular advantage in using a Pacific type locomotive in preference to an Atlantic type provided the latter has as large a boiler as the former. It is a simple matter to use the same size cylinders in the two cases and deliver the same power. Limitations of the weight allowed per axle of passenger locomotive on most roads, however, compel the use of three driving axles in order to carry the requisite boiler to supply the power needed for the heavy train. These weight limitations are, of course, principally governed by considerations that affect the track structure rather than any feature of design of the locomotive.

It was believed by the locomotive designers of the Pennsylvania that it would be possible to build an Atlantic type locomotive which would have sufficient boiler capacity for very heavy passenger work and still not have any more serious effect on the track than the Pacific type locomotives in use. They realized, of course, that this large boiler was going to place great weight on the drivers, but believed that by extreme care in the design of the reciprocating parts, it would be possible to so reduce the weight in the counterbalance as to bring the combined static and dynamic weight on the track to a figure below that ordinarily given by locomotives with much less dead weight on the axle. This they proceeded to do and with complete success. To be sure, the weight per driving axle is nearly 67,000 lb. at the rail, but, on the other hand, the weight of the reciprocating parts on each side of the locomotive is but 1,000 lb. Balanced for 70 miles an hour, with 80 in. drivers, the dynamic augment of the counterbalance weight is less than 30 per cent of the static weight on the wheels and, when combined with the static weight, gives a total blow on the rail of less than 87,000 lb. This is little, if any more than the blow given by most Pacific type locomotives which have 55,000 lb. static weight per axle at the rail.

We then have here an Atlantic type locomotive with practically the hauling capacity of a Pacific type and with a total weight about 60,000 lb. less. This saving in weight can be placed in the train and the locomotive should be capable of hauling a heavier trailing load than a Pacific type with the same size cylinders and drivers. As a matter of fact this locomotive has shown itself to be capable of pulling an extra car on the same schedule.

In the detailed description of the construction of this locomotive which will be found elsewhere in this issue, it will be readily apparent to the locomotive designer how the result has been accomplished. Briefly, it consists of taking advantage of the very best quality of material and using it in a form which will allow the full advantage of the increased strength to be obtained.

Experience with the first experimental engine of this type indicated that it would be necessary to develop a new scheme for equalization if an easy riding locomotive was to be obtained. Steps were taken to do this and the third engine of the series, which has proved to be so completely successful, is equalized in a very unusual manner for an Atlantic type locomotive. The result has been a smooth, comfortable riding machine.

Not the least interesting feature of the locomotive is the new trailer truck that has been applied. The truck frame in this case also acts as an equalizer, a combination which has worked out very satisfactorily. It is in the form of a single large steel casting which, while massive in form and of great strength, is remarkably light. It is held from movement in a horizontal plane at the radius pin and from movement in the vertical plane at the trailer truck journal but at all other points it is permitted a combination movement either horizontally or vertically as may be necessary for the radial action or the action as an equalizer. These two movements do not interfere with each other in any way.

Refrigerator Car Design

An article in the issue of January 30 of the Railway Age Gazette presents some very interesting facts in connection with refrigerator cars. In recent years the railways in general have been adding very materially to their amount of equipment of this kind till at the present time they now control over 63 per cent of the refrigerator cars in operation. The tendency appears to be toward a decrease in the number of privately owned cars of this class and it is advisable for the mechanical department to extend its knowledge of the features of design that are peculiar to this class of equipment. As is pointed out in the article, refrigeration is a science which requires a certain amount of careful study if it is to be successfully applied to railway equipment. Perishable freight, if not given the proper protection and care, will produce more claims per unit of neglect than any other class of freight. A refrigerator car is a cold storage plant on wheels, but its service is such that what might be entirely practical for an ordinary cold storage plant may not be practical in a refrigerator car. Likewise, the general type of box car construction cannot be followed in all its details in the construction of these cars.

The article states that since the extra weight of refrigerator cars is carried in the superstructure, which, together with the high or suspended load usually carried, will raise the center of gravity of the car an appreciable amount, there has been at one time or another a large number of derailments. When these have occurred it has been found that they can be almost entirely overcome by decreasing the distance between the side bearings and bringing them well inside of the rails. The standard practice in this regard now seems to be about 24 in. on each side of the center of the truck, with a clearance of ¼ in. to ⅜ in. Some car designers are strongly in favor of roller side bearings or some anti-friction arrangement which will assist the trucks in traversing curves, since the refrigerator car body is of such rigid construction that it will not ease off from the side of the truck as it strikes the elevated rail.

An excellent method of keeping refrigerator cars clean and free from permeating odors is suggested from the experience of one car company. This consists of applying two coats of hot linseed oil to the inside sheathing of the car and covering it

with a good grade of varnish. The oil will be absorbed as soon as applied, filling the pores of the wood and thereby preventing any material amount of absorption of any odors. The cars can then be kept clean with ordinary soap and water.

It is pointed out that the most vulnerable part of a refrigerator car is the insulation, and unless this is applied correctly it will very greatly decrease the efficiency of the car. An interesting test of the value the number of layers of insulation may have in a refrigerator car is reported. The purpose of this test was to determine whether or not it would be advisable to add an extra layer of insulation to some one-layer cars, and to compare the efficiency with that of a car provided with three layers of insulation. The test was a standing test and the car was empty. All four cars under test were iced at the same time with 7,300 lb. of ice and the temperatures were read on six thermometers scattered throughout the car, every four hours thereafter. A temperature of 48 deg. was maintained in the car with one layer of insulation for 18 hrs. and 30 min.; in the two-ply car it was maintained for 68 hrs., and in the three-ply car, 115 hrs. and 30 min. The ice lasted 196 hrs. in the first car; 216 in the next, and 236 hrs. in the three-layer car. Another test of the value of insulation was made on two cars, one of which had two layers of ½ in. Linofelt, and the other with six layers of the same insulation. These cars made a nine days' journey with an average outside temperature of 68 deg. The two-layer car consumed in this journey, 12,055 lb. of ice and the six-layer car, 8,410 lb. of ice. On arrival the temperature in the two-layer car was 42 deg., and in the six-layer car about 43 deg. This test showed that the heat transmission through the two-layer car was at the rate of 5.1 B. t. u. per square foot of exposed surface for 24 hrs. per degree of difference between the inside and outside temperatures. For the six-layer car the amount of heat transmission was only 3 B. t. u. on the same basis. The maximum variation for 24 hrs. in the six-layer car was 2 deg., and in the two-layer car it was 6 deg. These tests very clearly indicate the necessity of not only using ample insulation, but using the best quality and applying it in the best manner. The article illustrates a number of recommended arrangements for insulation applications.

The Road Foreman of Engines

The road foreman of engines, or traveling engineer, holds a most important position as a railway officer. The nature of his duties is such that, if he is the right type of man, he can become a power in the economical operation of trains; on the other hand, if he is not the right man for the position, he may, unless he is promptly checked, cause a rapid deterioration in the quality of the service rendered by the enginemen over whom he has charge.

In an article on this subject in the Railway Age Gazette of February 6, the question of temperament is placed first as the one demanding the greatest consideration in the selection of a road foreman. The article states:

"In choosing a man from the ranks for the position of road foreman there are several things to consider. A man may have a good record as regards freedom from accidents; he may have a record for saving fuel; he may be able to get his train over the road under trying conditions: he may have an unusually thorough knowledge of the locomotive. One or more of these reasons frequently will be made the prime factor in the selection of road foremen. Without question they are matters of great importance and are to be given careful consideration in deciding on the man for the place. But should any one of them, or all of them combined, constitute the deciding factor in making the final selection? This is a weighty question, and a little study of the nature of the work may help in answering it.

"Now, the road foreman is a teacher. To be a thoroughly competent officer, he needs all the temperamental characteristics of the most successful educator. He is placed in direct charge of the enginemen and the firemen in his district, and he has, or ought to have, charge of the selection and training of firemen. It is through his training and under his direction that these young men become enginemen, and their ability as runners depends to a great extent on the road foreman. Moreover, a considerable part of this officer's work is the conducting of investigations; and in order to properly weigh the evidence and decide with absolute fairness on the discipline necessary in such cases, he must be thoroughly capable of acting in a judicial capacity.

"Summarizing, then, the characteristics which should obtain in a man if he is to successfully fill the position of road foreman of engines: He should be of an even temperament and of a disposition which will command the friendly feeling and the respect of those under him; he should be capable of training men; and in investigations, he should be capable of getting at all the evidence, weighing it judicially, basing his decision on sound reasoning and then enforcing discipline impartially. In brief, he should combine the qualities of a student of human nature, a skilful educator and an impartial judge. He should also have a thorough knowledge of the locomotive and its efficient handling, and of course, be thoroughly acquainted with all the rules regarding the operation of trains."

Too little attention is generally given to the selecting of men for the position of firemen. There have been, of course, times when it was necessary to take almost any man who came along and applied for a place; but even at such times a better class of men could have been obtained had a competent road foreman hired the man, rather than some one totally unacquainted with the operation of locomotives. In treating this phase of the subject the article says:

"The selection and training of firemen, who are to be the future enginemen, should be given at least as much care as the selection and training of shop apprentices; and the man who understands better than anyone else the type of man that will produce the best results in this service is the road foreman. The road foreman has the chief responsibility in training the man after he is accepted, and he should personally select the material with which he has to work. The selection is too important to be settled without his aid. In order to do this intelligently he must be a student of men, their characteristics and their habits."

Good results cannot be expected from a road foreman if he is overworked. This naturally brings up the question of how much work should be assigned to a road foreman. There has seemed, in the past, to be a tendency toward placing too many crews under one foreman's supervision, and when this is done he cannot do justice to any crew. Under such circumstances he seldom rides with a crew unless so directed by his superiors because the men in question are not doing good work. In the article from which we have quoted, emphasis is laid on the success of the system, now in force on a number of roads, of requiring the road foreman to visit each of his crews once in a certain period of time, 30 days being generally fixed as the limit for this purpose. In conclusion, three principal considerations are outlined for the selection of road foremen:

"(1) Consider first the temperament of the man; his ability as an engineman and his other characteristics should be secondary to this.

"(2) Make a careful study of what it is desired to have the road foreman accomplish and with this in mind fix the extent of his work so that he can keep in close and frequent touch with every man under his jurisdiction.

"(3) Give him absolute charge of the hiring of firemen and the training of both firemen and enginemen; then hold him responsible for the development of the right kind of men.

"Finally, if a system of supervision and training of engine-

men by means of road foremen is to be a success the officer who selects the road foreman must be a man who is wholly fitted for the position he holds. It cannot be reasonably expected that a master mechanic who is narrow minded, and who looks only at today and lets tomorrow take care of itself, will have under him any but men of the same type. In the final analysis, the type of man who holds the place of road foreman depends on the type of man at the head of the organization."

NEW BOOKS

Kansas Fuels: Coal, Oil, Gas. Engineering Bulletin No. 3 from the University of Kansas. Bound in paper. 6 in. x 9 in. 40 pages. Illustrated. Published by the University of Kansas, Lawrence, Kan. Copies free on request.

The heating values and proximate analyses of coal, as found in the different mines in Kansas, together with other important information concerning the mining and the general characteristics of the fuel are given in this bulletin. Similar analyses and information are also included in connection with oil and natural gas from the same regions.

Spontaneous Combustion of Coal. By S. W. Parr and F. W. Kressmann. Bulletin No. 46, University of Illinois. 87 pages. 6 in. x 9 in. Illustrated. Bound in paper. Published by the University, Urbana, Ill. Copies free.

In view of the fact that it is becoming quite general practice for the larger users to store quantities of fuel for the purpose of protecting themselves against labor difficulties at the mines or interference of transportation by weather conditions, a thorough investigation of the causes and prevention of spontaneous combustion is of decided value. This bulletin contains probably the most carefully prepared report on the subject that has yet appeared. In the conclusions, it lists the preventive or precautionary measures that are suggested for the prevention of spontaneous combustion, especially with bituminous coals of the Illinois type.

Scientific Management. Addresses and discussions presented at the First Tuck School Conference, Dartmouth College. Bound in cloth, 6 in. x 9 in., 387 pages. Published by the Weekly Bulletin Publishing Co., Boston, Mass. Price $2.50 net.

This book contains a complete report of the conference on Scientific Management held at Dartmouth College under the auspices of the Amos Tuck School of Administration and Finance, including papers on the principles of scientific management, scientific management and the laborer, scientific management and the manager, discussions of the applicability of scientific management in certain industries, scientific management and government, and other phases of scientific management. Among the the authors are included Henry B. Quinby, ex-Governor of New Hampshire; Ernest Fox Nichols, LL.D., President of Dartmouth College; Frederick W. Taylor, consulting engineer; Henry L. Gantt, consulting engineer; Harrington Emerson, consulting engineer, and other experts who are noteworthy in scientific management.

Analyses of Coals in the United States. By N. W. Lord. Bulletin No. 22, Department of the Interior, Bureau of Mines. In two parts. Bound in paper. 6 in. x 9 in. 1,200 pages. Illustrated. Published by the Bureau of Mines. Copies free.

This bulletin contains, in the first part, analyses which have been made by the United States Geological Survey and the National Bureau of Mines from 1904 to 1910 of over 10,000 samples of coal collected in the United States. In the second volume are full descriptions of the samples that are shown by analyses only in the first part. These descriptions have been compiled from the note books of the persons who collected the samples and present such information regarding the character of the coal, the impurities in the beds sampled and the nature of the roof and the floor of the bed, as has a definite bearing on the significance of the analysis of the samples. They also give supplementary details as to the capacity or output of the mine, the methods used in mining, the preparation of the coal and the chief uses to which it is put. The bulletin contains chapters by J. A. Holmes, F. M. Stanton, A. B. Fieldner and Samuel Sanford.

American Railway Master Mechanics' Association. Proceedings of the 1913 convention. Illustrated. Bound in cloth. 856 pages, 6 in. by 9 in. Published by the Association, Joseph W. Taylor, secretary, 1112 Karpen building, Chicago, Ill. Price $5.

The proceedings of the 1913 convention include, in addition to the full text of the reports and discussions of the various committees, a reprint of the Pennsylvania Railroad report on the tests of a superheated steam Atlantic type locomotive, which formed an appendix to the report of the committee on superheaters. This section makes the book of unusual value for reference, since the tests were most complete in every particular and contain data of great value to all locomotive designers. The volume contains the list of committees that will report at the 1914 convention as well as the usual matter included in the proceedings of the larger associations in connection with the list of members, etc.

Master Car Builders' Association. Proceedings of the 1913 convention. Illustrated. Bound in cloth. 1142 pages, 6 in. by 9 in. Published by the Master Car Builders' Association, Joseph W. Taylor, secretary, 1112 Karpen building, Chicago, Ill. Price $10.

Each year the report of the proceedings of the convention of the Master Car Builders' Association has continued to grow in size, and in 1913 it reached a total of 1,142 pages in addition to 90 double page charts. This has made it advisable to publish it in two parts. Part I contains the reports of the committees at the last convention with the full discussion thereon, reports of the officers and the minutes of the meetings of the executive committee. It contains 666 pages. In Part II are the rules of interchange, the results of latter ballot and the standards and recommended practice of the association. The price has been increased from $7.50 to $10.00. This includes both volumes. At the 1913 convention there were reports from 29 different committees discussed in addition to three subjects for topical discussion. Many of these were of the utmost importance and value to the railways of the country. The volume contains the names of the members of the different committees which will report at the 1914 convention, as well as a full list of the members of the association with their addresses and the number of cars represented.

Working Drawings of Machinery. By Walter H. James and Malcolm C. McKenzie. Bound in cloth. Illustrated. 6 in. x 9 in. 140 pages. Published by John Morley & Sons, 432 Fourth avenue, New York. Price $2.

While this book is planned especially to meet the needs of the second and third year students who are studying drawing in the department of mechanical engineering at the Massachusetts Institute of Technology, it is not by any means a text book, but rather takes the form of a treatise in the application of mechanical drawing to the describing or designing of machinery. It gives a correct conception of the character and purpose of a working drawing, exact relation between the pictorial drawing of an object and its orthographic projection, and illustrates good modern practice in methods of representation, dimensions, drafting room systems and the like. Further it explains briefly, from the standpoint of the engineer rather than from the architect's, a few of the common methods of pictorial representation, particularly of mechanical perspective. The text is clearly expressed and the illustrations are on a scale well suited to the size of the page.

COMMUNICATIONS

TURNING DRIVING WHEEL TIRES

HUNTINGTON, W. Va., January 16, 1914.

TO THE EDITOR:

I note in the June, 1913, issue on page 336 a record for turning driving wheel tires at the Richmond shops of the Chesapeake & Onio, and in the December, 1913, issue, page 640, the record made at the Clifton Forge shops of the same company.

We have at the Huntington shops of the Chesapeake & Ohio one of the latest types of heavy, high duty, driving wheel lathe manufactured by the Niles-Bement-Pond Company, and of the same pattern on which the two above mentioned records were made. This machine differs, however, in the method of drive. In the other tests the machines were driven by direct current motors which give a wider variation of speed. In the test noted below the machine was driven by a 50 h. p. 440 volt 3 phase alternating current, motor at 900 r. p. m.

By careful attention to the details we turned the following set of Mallet locomotive driving wheel tires, consisting of six pairs, in a total time of 2 hr. 24 min. The depth of cut was ¼ in. on the side, making ½ in. reduction in diameter. The original diameter of the tires was 56 in. They were very hard and the small reduction did not permit us to get under all of the hard spots.

Pair No.	Time Chucking. Min.	Time Finishing. Min.	Time Removing. Min.	Time, Floor to Floor. Min.	Cutting Speed. Ft. per Min.
1.....	3	18½	1½	23	11
2.....	3	18	2	23	11
3.....	3	23	2	28	11
4.....	3½	19	1½	24	11
5.....	3	20	2	25	11
6.....	3	16½	1½	21	11

Average time turning, 19 min. 10 sec. Average time removing from lathe, 1 min. 45 sec. Average time from floor to floor, 24 min.

H. M. BROWN
Shop Superintendent.

DOES THIS FIT YOUR SHOP?

NEW YORK, January 19, 1914.

TO THE EDITOR:

I have been much interested in the articles entitled, "College Men and the Railroads."

I first entered a technical college, but after a year of it, I decided that it would not help me in the mechanical department of a railroad, so I left. I am now a machinist's helper in the erecting shop of one of the largest shops in the East, and should like to know if other shops are managed the way this one is.

A locomotive comes into the shop and stripping is begun. Quite a few parts are broken or distorted by rough handling. Smaller parts, such as brackets, are thrown to the ground or into the pit. A sweeper comes along and shovels the dirt, ashes, lagging, and some of these small parts into a wheelbarrow and the contents of the latter are thrown away. Nothing would be easier than to have boxes to put the parts in. A farmer taking a machine apart knows enough to do that.

It is the same with the bolts and nuts, many of which are removed in perfect condition—they are thrown down and swept away.

Pipes, copper as well as iron, are frequently lost in the same way.

Then, when it comes to assembling the locomotive, how do they replace the missing parts—order new ones? No—send a man outside and take that part from an engine of the same class which is waiting to come into the shop. All this takes extra time. Often the part won't fit, so a man is put to work chipping and filing it—marvelous efficiency.

As to the tools, most of them are in poor condition. If a man was employed especially to keep the wrenches up to gage, to retemper chisels and repair other tools, his wages would be saved many times over.

Another thing—anyone grinds drills, chisels and lathe tools. I thought it an indisputable fact that the only economical way was to have certain men do all the grinding. Cutting tools will not work efficiently if ground with a wrong angle.

I do not say that everything is done badly, nor do I pretend to know it all, but it seems to me that in some of these practices, there is room for improvement. HELPER.

YOUNG VALVE GEAR

SOUTH BETHLEHEM, Pa., January 10, 1914.

TO THE EDITOR:

I noticed on page 43 of the January issue, the description of a new valve gear designed by O. W. Young, of Schenectady, N. Y. In going over this article I note that Mr. Young made a mistake in comparing his valve gear with the Walschaert. In the valve ellipses presented, Mr. Young uses a valve travel of 6½ in., 1⅛ in., lap, ¼-in lead and ⅛-in. inside clearance on the Walschaert gear, and 8½ in. travel, 1¼ in. lap, ⅜-in. lead and ¼-in. inside clearance for his valve gear. He then goes on to state that his gear gives 50 per cent wider port opening at all cut-offs.

The error lies in the fact that he should have considered all things, including valve travel, lap, lead, etc., the same on both gears when making the comparison. There has been much talk in regard to patent valve gears and their nicety of steam distribution, when compared with the Walschaert gear. In actual practice, however, we do not get this nicety of steam distribution. If Mr. Young would construct valve ellipses for the Walschaert gear, and ellipses for his gear, taking the same lap, lead, valve travel, etc., in both gears, I believe he will find that the steam distribution given by his gear will not be so much better than that given by the Walschaert. Furthermore, the valve travel of 8½ in. assumed by Mr. Young is, I believe, impractical, especially with the slide valve engine, for the reason that the speed of the valve would be so high that it would be a very difficult matter to lubricate the valve properly. A. L. ROBERTS,
Mechanical Engineer.

[Mr. Young's reply to the above criticism is given below.—Editor.]

SCHENECTADY, N. Y., January 15, 1914.

TO THE EDITOR:

The Walschaert gear is above criticism up to 6½ in. valve travel with proportionate lap and lead. It is now being frequently arranged for 7 in. travel, but at the expense of very objectionable angularities.

The comparison made was between what is thought to be the fair limit of capacity of the two gears and is solely for the purpose of indicating the need of a gear that will take care of the large cylinder volumes now being used.

It shows a logical reason why the large engines do not develop a draw bar pull at high speed at all proportionate to their size, when compared with smaller engines. No special claim is made for the Young gear in the way of improved distribution when the travel, lap, lead and clearance are the same as in the Walschaert gear. The valve movement is then almost identical, but the point is made that the Young gear has capacity for greater travel without excessive angularities. This permits more lap, lead and exhaust clearance, and in consequence wider openings without change in the time of the events. Pre-admission, release and closure will take place at the same period of the stroke, but the added area will facilitate the rapid flow of larger volumes. A pair of 16 in. piston valves with their stems frequently weigh 700 pounds. A decided increase in port openings permits the use of smaller valves without decreasing the efficiency of the engine.

It is only at high speed in the running cut-off that the matter of lubrication need be considered. Is it probable that 20 per cent increase in travel will introduce additional difficulties in view of the fact that the valve will wipe a greater portion of its seat

that has been exposed to oil saturated steam? On the contrary, is it not the case that immediate relief for dry valves in practice is to drop the reverse lever a few notches for the purpose of increasing the travel? Slide valves need not be considered in this connection for that type of valve is now obsolete, when superheat is used.

I am arguing for a gear of greater capacity than those now in use, and not especially to promote the identical gear under discussion if some other arrangement can be found that will produce equally good results. O. W. YOUNG.

COLLEGE MEN AND THE RAILROADS

LA FAYETTE, Ind., October 18, 1913.

TO THE EDITOR:

My attention has been called to the communication in the October number of your magazine and to the editorial comment. I am naturally much interested in this discussion, as college faculties are anxious to know whatever may be lacking in the education and training of graduates and how any deficiencies may be made good.

The first purpose of every college, whether technical or non-technical, should be to send forth its graduates with minds well trained for action and with a fair equipment in general arts and sciences. Further than this, the technical institution may give some training in mechanics and engineering. It may not, however, attempt to specialize very much in the various branches of engineering without danger of weakening the fundamental courses.

Four years is not time enough in which to take the average high school graduate and make of him a mechanical or civil engineer, much less a railroad engineer. To do this successfully means the addition of one or two years to the college course and a corresponding delay in the start in a profession.

A certain amount of railroad training is given at Purdue University as an elective in the senior year and represents about a third of the time of that year in class room, drawing room and laboratory. There are such electives in the schools of civil, mechanical and electrical engineering, fitting the graduates to enter positions in the maintenance of way, motive power or electrification departments respectively. That a considerable number of Purdue graduates have continued in railway work is evidenced by the following table which shows the professions in 1911 of those who had graduated up to that time in the schools of civil, electrical and mechanical engineering. The list given represents about 95 per cent. of the living graduates from those schools:

	Civil.	Electrical.	Mechanical.
Banking	1	0	7
Bridge construction	31	4	3
Civic railways	11	42	4
Construction and contracting	112	13	37
Consulting work	19	9	8
Farming and farm products	12	10	17
Graduate students	5	3	5
Heat, light and power	8	57	20
In public service:			
United States	53	24	13
States	6	4	3
Cities	45	3	8
Other	10	2	2
Lawyers	1	8	5
Manufacturing:			
Motor	..	13	31
Railroad	..	3	23
Iron and steel	15	12	40
Other mechanical	4	14	126
Electrical	2	113	30
Miscellaneous	53	50	133
Mercantile work	17	45	74
Printing and writing	2	2	9
Real estate and insurance	6	2	3
Steam railroads	194	36	122
Teaching:			
College	20	28	52
High school	6	15	29
Telephone and telegraph	1	58	3
Miscellaneous	5	2	10
Not specified	10	206	13
Total	649	778	830

Grouping those who are directly or indirectly associated with railroad work, we have the following comparative table:

	Direct.		Indirect.		Total.	
School.	No.	Per cent.	No.	Per cent.	No.	Per cent.
Civil	205	31.5	107	16.5	312	48
Electrical	81	10.4	29	3.7	110	14.1
Mechanical	149	18	51	6.1	200	24.1

Note.—One-half of those listed in contracting, consulting or college teaching are considered as indirectly associated with railways. The percentages are based on the totals for each school as given in the first table.

If there should be added to the above list the names of those who are engaged in manufacturing railway equipment, the proportions would be still greater.

That there are many who fall by the wayside is undoubtedly true. In the first place, the railway apprenticeships are not always of a character to attract bright, well educated young men, and in the second place the young men themselves frequently lack stability.

I have not found apprenticeships of any sort particularly attractive to college graduates. The terms of service appear long after a four years' grind at college, and the pay is usually not as good as the graduate can get elsewhere.

Perhaps the boys are a little spoiled by the apparent over-demand for their services, but when a young man has several jobs offered him after graduation and meets the representatives of three or four manufacturing companies who wish to apprentice him, he is hardly to be blamed for over-estimating his abilities.

I agree with your correspondent that the apprentice course for graduates should not be more than two years and that pains be taken in that time to teach the apprentice what he needs to know. This will be a good investment for both the road and the man. Too often the apprentice is left to shift for himself under the grudging guidance of an indifferent foreman.

I believe the first year should be one of well-directed hard work in the shop, so as to make the student understand not only the shop work but the shop men and their point of view. The second year he should be advanced to special problems, laid out with reference to what they teach, so as to give him what he needs without waste of time. His pay should be at least equal to what his mates can command outside. Unless the railroads feel that they can do this much, it would be better to abandon the special apprenticeship. It is idle to expect to throw men in a hopper and have them come out trained engineers.

Granted, however, that the apprentice system is all that it should be and that the graduate has the opportunities he needs, he will frequently fail for lack of stability and continuity. This is illustrated by the comments of various railroad officials in letters which I have received in reply to a questionnaire which I had sent out and which invited criticism.

I believe it is the duty of railroad officials in dealing with young men to be frank with them and explain to them the nature and purpose of the novitiate, what is expected of them and what they have a right to expect. Some of the troubles alluded to have probably arisen from a misunderstanding on the part of the student.

On the other hand, I think it is the duty of college teachers to impress on their students the serious nature of a business engagement and the definite obligations of service.

The student should be made to see that training for railroad work is not a matter of months, but of years—that what he does or what he earns today is of little importance compared with the opportunities which lie in the future for those who give faithful and conscientious service. C. H. BENJAMIN.

ELECTRIFYING RAILWAYS IN NORWAY.—In Norway the government proposes to carry out quite an extensive scheme for applying electric traction to the railways. According to an official report as to hydraulic resources, the state already owns enough water power to serve for nearly all the railways in the south and west of the country.—*Scientific American.*

NOTABLE ATLANTIC TYPE LOCOMOTIVE

Pennsylvania Railroad Class E6s; Heaviest Weight on Drivers and Minimum Weight of Reciprocating Parts

The most interesting and advanced locomotive design in America at the present time is an Atlantic Type locomotive developed by the Pennsylvania Railroad. This design is not only prominent for the fact that it carries a weight on drivers equal to the heaviest ever used in this country, the lightest weight of reciprocating parts of any locomotive with equal sized cylinders, the greatest capacity for sustained pull at the drawbar at high speed and similar record-breaking features, but also for the perfection and refinement of all of its details and the origination of an entirely new method of the equalizing and distributing the weight between the carrying wheels.

The high state of perfection reached in this design is the result of several years' study and experiment. The special facilities possessed by the Pennsylvania Railroad for investigating all the features of locomotive design and operation in the greatest detail have also had their effect. The position occupied by the motive power department on this road, which carries with it the full confidence of the management and hence a free hand to progress along the most advanced lines, is the principal cause that has permitted the production of this most successful locomotive.

The Heaviest and Most Powerful Atlantic Type Locomotive Ever Built

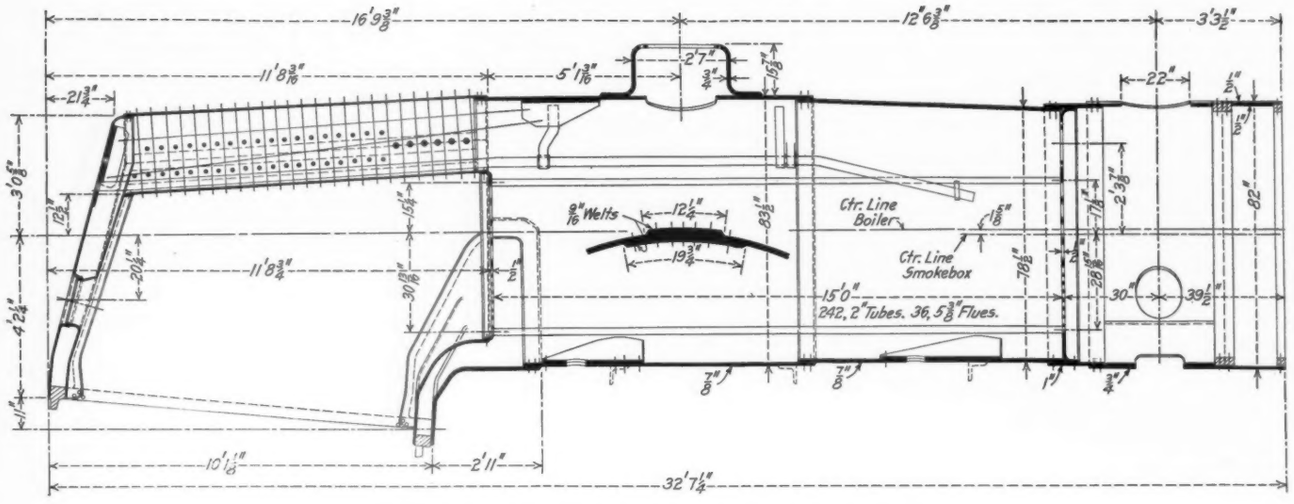
It was in 1910 that the first step in the development was taken, and at that time a very large and powerful Atlantic type locomotive was designed and built. This was illustrated in the American Engineer and Railroad Journal in April, 1911, page 124. This locomotive had no super-heater, but was fitted with a brick arch and large combustion chamber. Its operation was carefully studied, tests were made with it on the locomotive testing plant at Altoona, and in 1912 a second locomotive of the same type was built. In this case, a Schmidt type of fire tube super-heater was applied, various improvements were made in the matters of weights and materials, and this locomotive was put in regular service. It was later placed on the locomotive testing plant and a most thorough and extended series of tests were undertaken. The results of these tests formed part of the report of the committee on super-heater locomotives presented at the 1913 convention of the American Railway Master Mechanics' Association. They are included in the volume of Proceedings for 1913.

On the basis of the tests and service of the two Atlantic type locomotives already mentioned, the present design was made. A few engines were built, and, after a short service had shown that the desired ends had been reached, orders were placed for a large number of the same class, which are now under construction at the Juniata shops. They are used for the heaviest class of high-speed passenger traffic, and even when compared with very large and powerful Pacific type locomotives, have been able to give a surprisingly good account of themselves. They are in many cases pulling trains with greater satisfaction than was previously obtained with Pacific types.

The total weight of the locomotive is 240,000 lb., and the weight on drivers is 133,100 lb. This apparently excessive weight on the drivers is permitted because the dynamic augments per wheel due to the counterbalance at a speed of 70 miles an hour, is less than 30 per cent of the static weight on drivers. As a result, these locomotives do not deliver as heavy a blow on the rail, nor do they have as bad an effect on the track, so far as strain is concerned, as the majority of passenger locomotives which have a weight on drivers 10,000 to 12,000 lb. less per axle. It is because of this feature that it is possible to apply the very powerful boiler that is used. It thus appears that the sustained capacity of the locomotive, which is entirely dependent on the boiler, is permitted by the care that has been taken in the design of the reciprocating parts to obtain the minimum weight with the great strength required for the amount of power that is transmitted from the large cylinders. The success attained in this particular is indicated by the fact that the weight of reciprocating parts on each side of the locomotives is less than 1,000 lb.

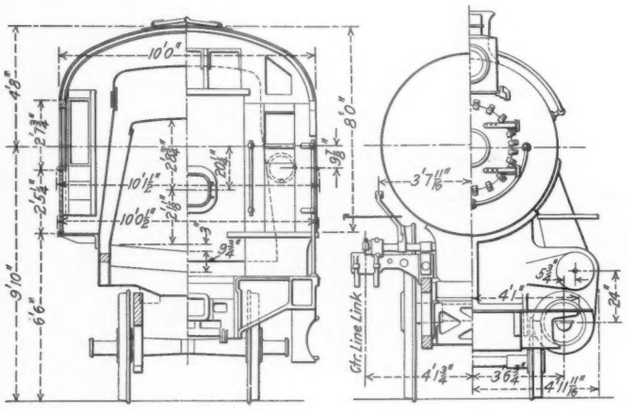
Perhaps the most striking innovation is the method of equalization. The Atlantic type has almost universally been built with an independently equalized front truck, and both pairs of drivers and the trailing truck are equalized together on each side. In this case the front truck is equalized with the front drivers, and the trailing truck with the rear pair of drivers. This gives the locomotive a condition similar to a two-truck vehicle like a car, and has made a remarkably easy riding machine, which is exceptionally free from destructive action on the tracks. At the same time the efforts towards good riding qualities have been extended to the tenders and an entirely new form of solid frame pedestal type truck has been designed for the tenders. The details of this construction will be considered later.

Heat treated alloy steel has been freely used throughout the design, and sections have been adopted which take full advantage of the increased strength of this material. The advantage

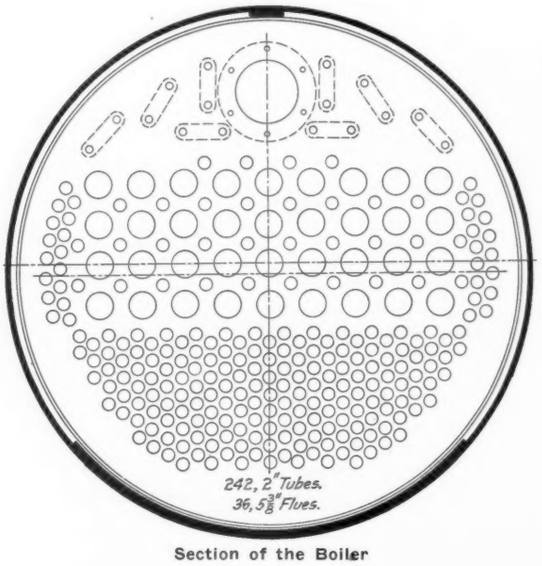


Largest Boiler Ever Applied to an Atlantic Type Locomotive

taken of the opportunity for light weight in this direction was responsible for the solution of several difficult problems.



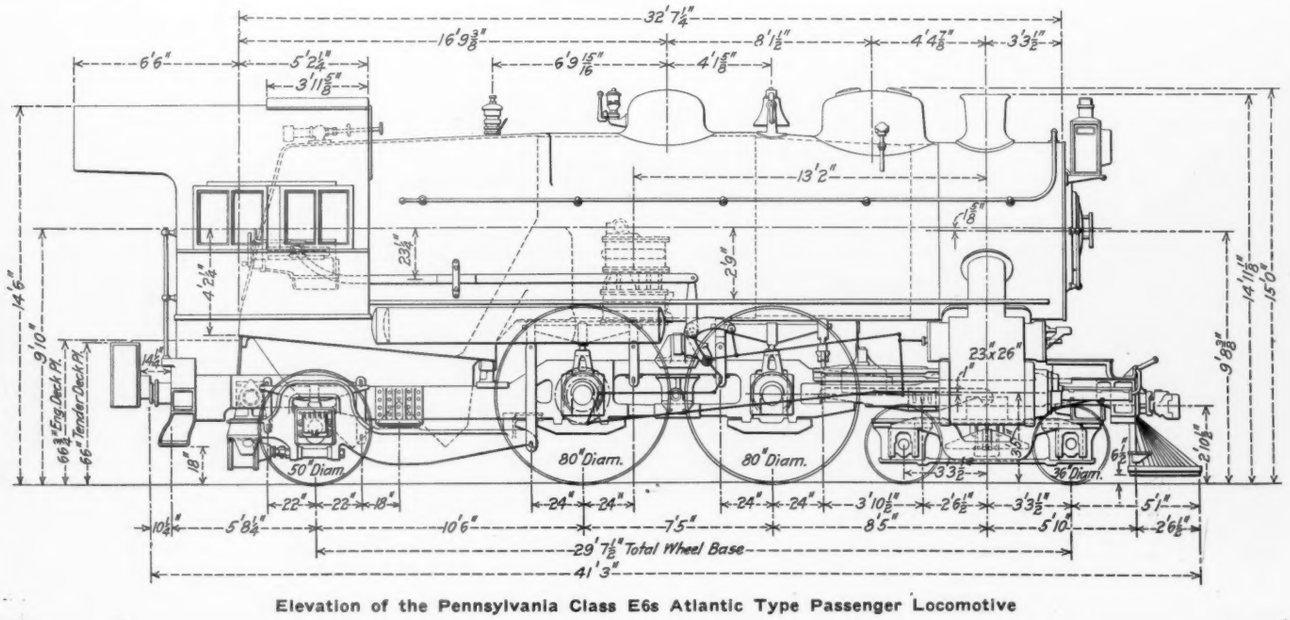
End Elevations and Sections



Section of the Boiler

BOILERS

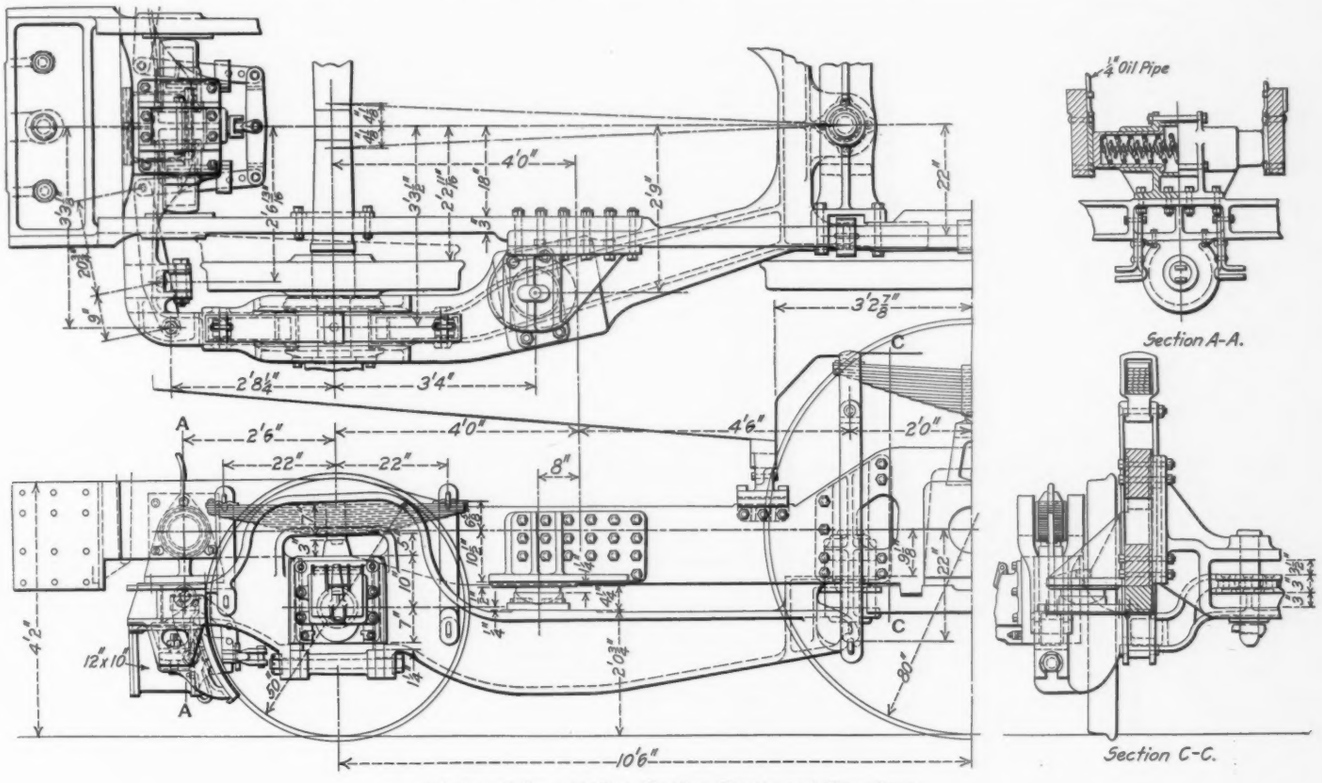
One of the illustrations shows the section and also the arrangement of the tubes of the boilers. It is of the Belpaire



Elevation of the Pennsylvania Class E6s Atlantic Type Passenger Locomotive

type, provides a grate area of 55.13 sq. ft. and has a short combustion chamber. The outside diameter is 78½ in. at the front end and 83½ in. at the dome. This has allowed the insertion of 242-2 in. tubes and 36-5⅜ in. superheater flues.

In the previous locomotives of the series the tube length was diameter from 94 to 103. This somewhat shortened the combustion chamber and gave a heating surface for the tube of 2660.5 sq. ft. The heating surface in the firebox is 195.7 sq. ft., and the total evaporating heating surface, 2856.2 sq. ft. The 36 unit superheater has a heating surface of 721



Details of Combination Trailer Truck and Equalizer

13 ft. 11⅝ in., but the indications from the tests were that as the tube length is increased there is a corresponding increase in efficiency and a decreasing possibility of forcing the boiler rapidly. A study of these tests led to the selection of a length of 15 ft. for the tubes. Beyond such a length, little is gained in increased evaporation, though efficiency will continue to increase. The 15 ft. tubes in the latest boiler increase the ratio of length to sq. ft. and, if the ratio of 1½ for the superheater surface is accepted, this gives an equivalent heating surface for the boiler of 3937.7 sq. ft.

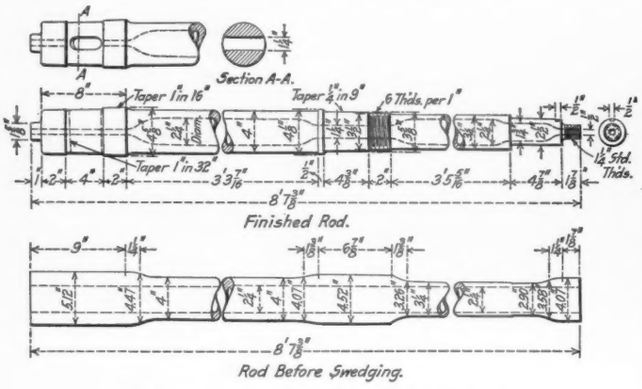
The boiler is fitted with a brick arch carried on three water tubes, and the grate is arranged with a slope of about 1 per cent towards the front. The construction provides ample depth at the throat, and the use of the shallow combustion chamber

The Trailer Truck Frame Also Acts as the Equalizer

increases the flameway sufficient to give very excellent combustion.

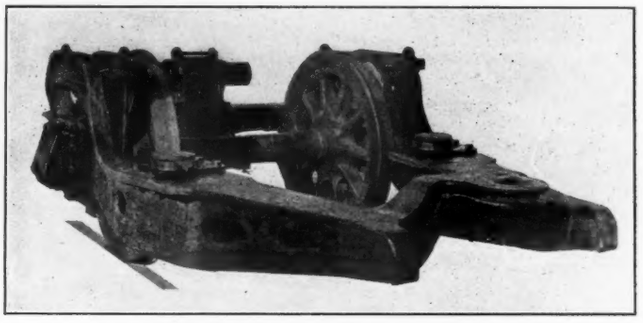
EQUALIZATION

One of the illustrations shows the detailed arrangement of the equalizers and spring rigging between the first pair of drivers and the engine truck. The illustration showing the details of the trailing truck illustrates the connections at the rear of the locomotive.



Hollow Piston Rod of Heat Treated Steel

It will be seen that the centre plate of the four-wheeled engine truck is carried by heart-shaped hangers in the usual manner, and that the center pin has taken the shape of a large diameter drum, which is inclosed on the side by the casting secured to the bottom of the cylinder. In the center cavity is a close-fitting, loose center plate, which rests on a lubricated face. Liners can be inserted under this plate for leveling. The top of the center plate is hollowed out, and the end of the equalizer takes a cylindrical shape bearing on top of it. The fulcrum of the equalizer is in a very substantial arched casting secured between the frames and having a lip underneath to relieve the heavy bolts of the shearing strain. The weight is thus transferred to the front frame rail immediately back of the cylinders, and at a point where it can be properly taken care of.

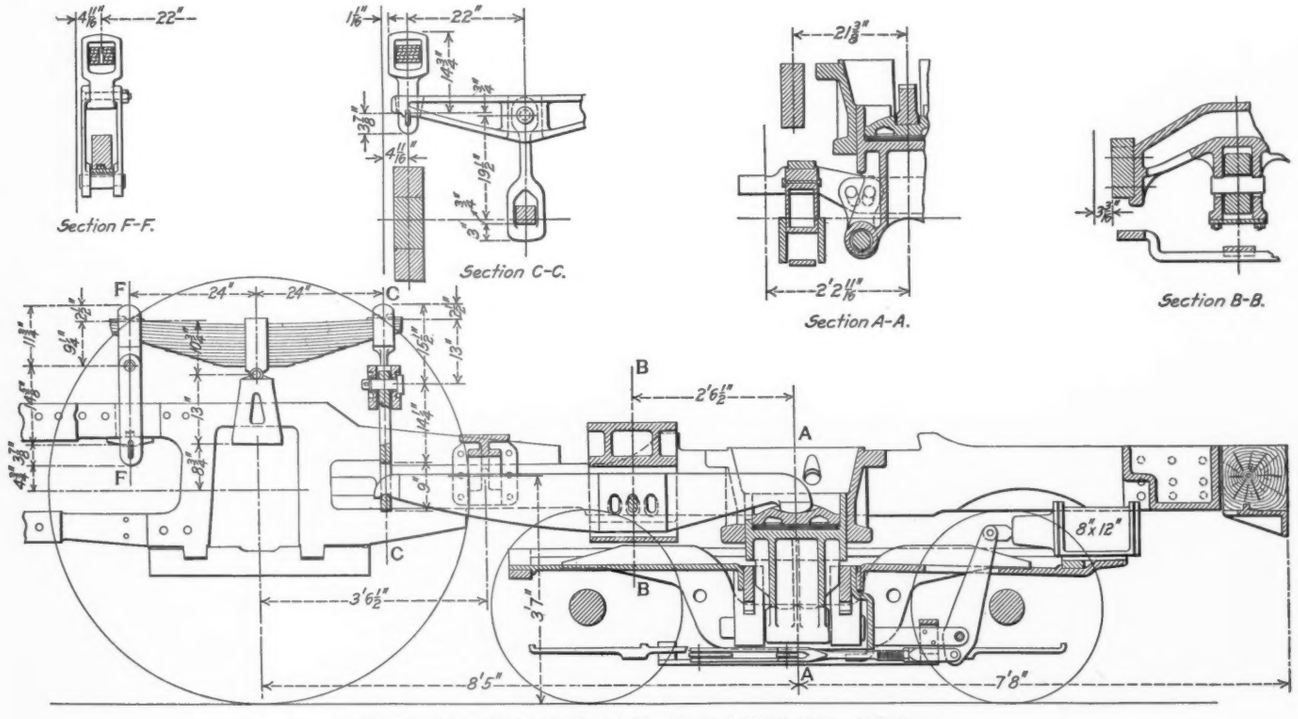


Trailer Truck for E6s Pennsylvania Locomotive

The remainder of the equalizing system is much the same as is frequently used with a two-wheeled engine truck. The details are shown in the illustration.

At the rear the trailing truck frame itself becomes the equalizer. This frame is a most substantial, carefully designed steel casting, all in one part, and is original in many of its conceptions. It is hinged to a frame cross brace at the center but is allowed a 3 in. vertical movement top and bottom on the pin.

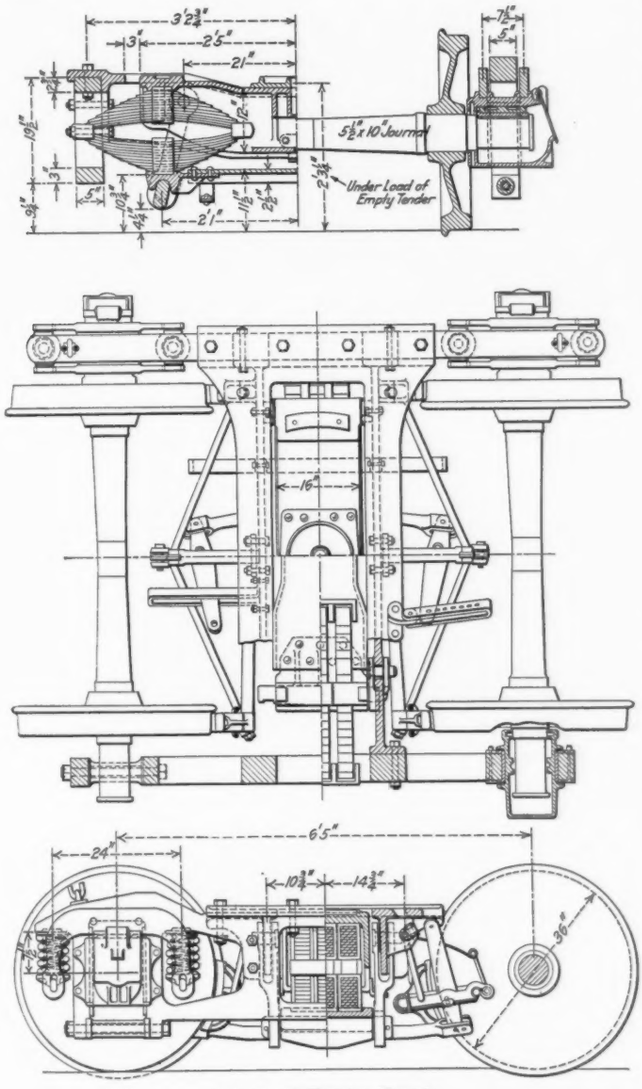
Section of Hollow, Extended Piston Rod on Pennsylvania Class E6s Locomotive



Equalization Between Front Truck and First Pair of Drivers

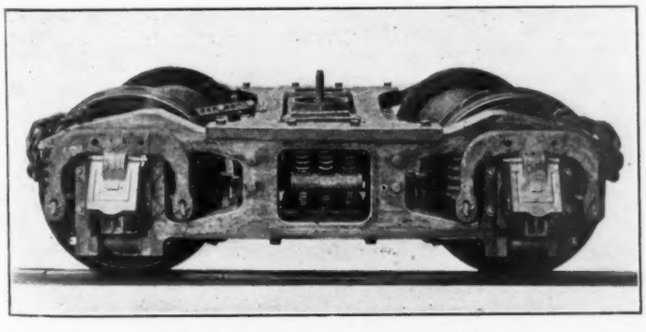
The location and arrangement of the combination sliding and ball and socket bearing on the bracket extending out from the trailer frame, and the arrangement of the spring over the trailing truck box are clearly shown in the illustration. The spring

centering device operates against lubricated plates on the inside of the rear frame. The bearing of the plungers on these plates is small in area, and since they are properly lubricated, this device will not interfere with the free vertical movement of the combination frame and equalizer.



Improved Tender Truck

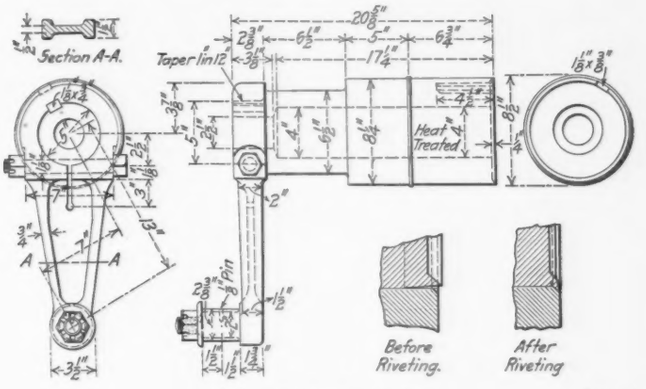
A very simple design of Walschaert valve gear has followed an exhaustive study of the results of tests and the best construction



New Tender Truck on the Pennsylvania

of various details. The parts have been made as light as possible by the use of first-class materials. Two interesting features are evidenced in an inspection of the illustration, one being the use of a fluting eccentric rod, the other the simple connection between the combination lever and the crosshead.

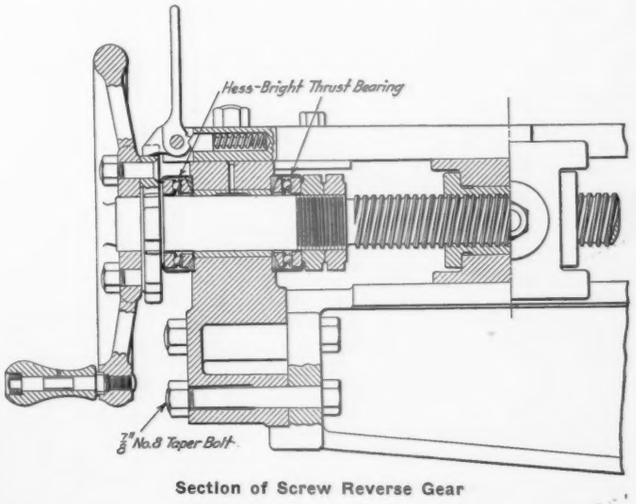
Much of this lightness of the valve gear parts has been permitted by the refinement in the design of the valve itself. It was realized that valves could be made much lighter than is common practice, and it was also believed that it was not necessary to have the large range of sizes so frequently found. After exhaustive tests it was shown that the piston valve could be largely standardized and that a 12 in. diameter was large enough for cylinders up to 27 in. in diameter. The standard 12 in.



Hollow Main Crank Pin

piston valve was then developed and, with only one change in over all length, it now fits locomotives of 14 different classes on this road. The main valve on this locomotive weighs but 118 lb. The head, or followers, are of drop forged steel, while the spool, or main body of the valve, is made of a piece of seamless tubing, the ends being solid or flanged pieces of boiler steel and the parts joined by electric welding. It has snap rings of *Z* section and an inside lip, or flange, is arranged to prevent the displacement of parts of the ring in case of a breakage. It will be seen that the valve stem crosshead is carried in a guide that forms part of the back steam chest head.

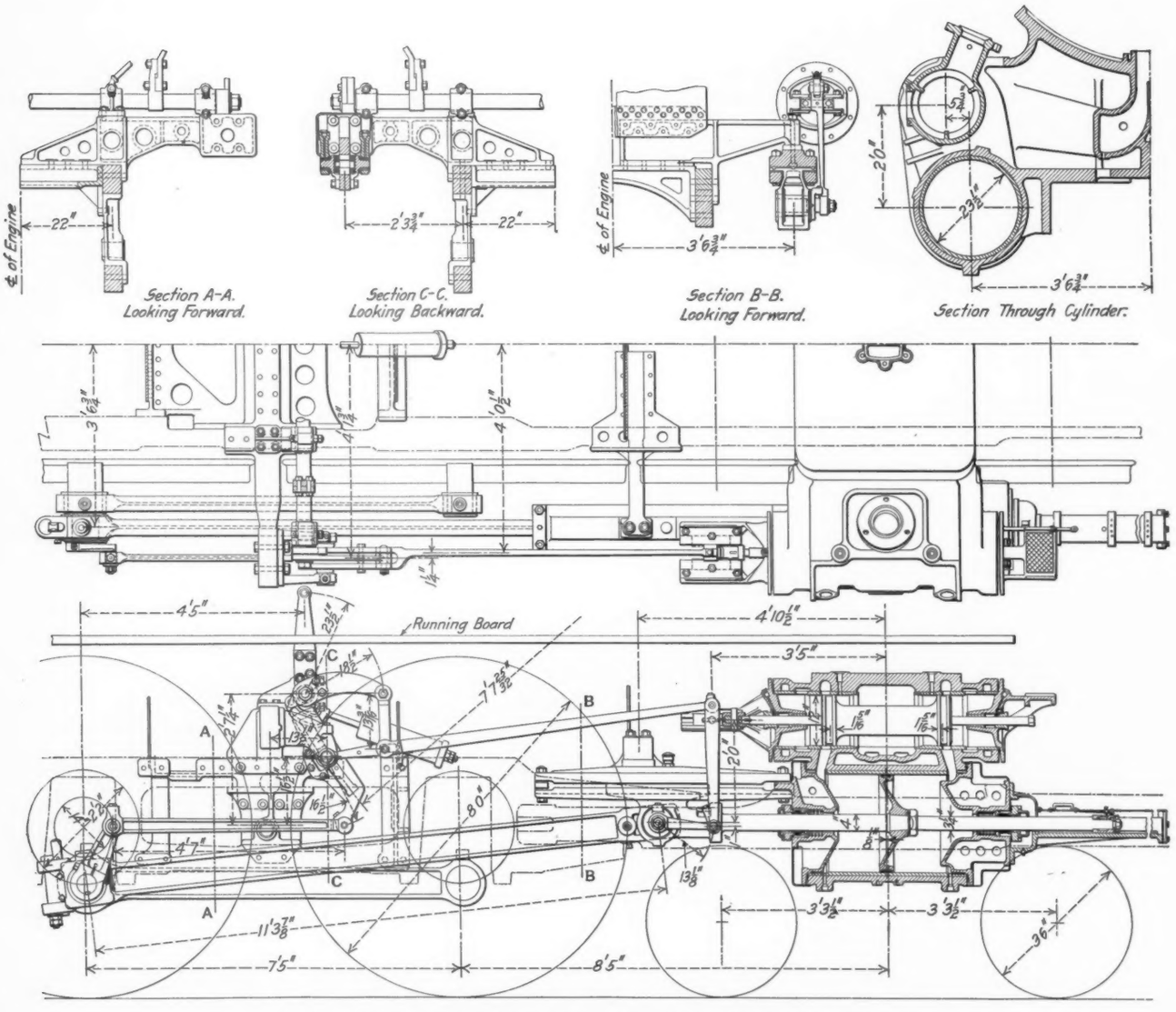
Possibly one of the most interesting details of the locomotives



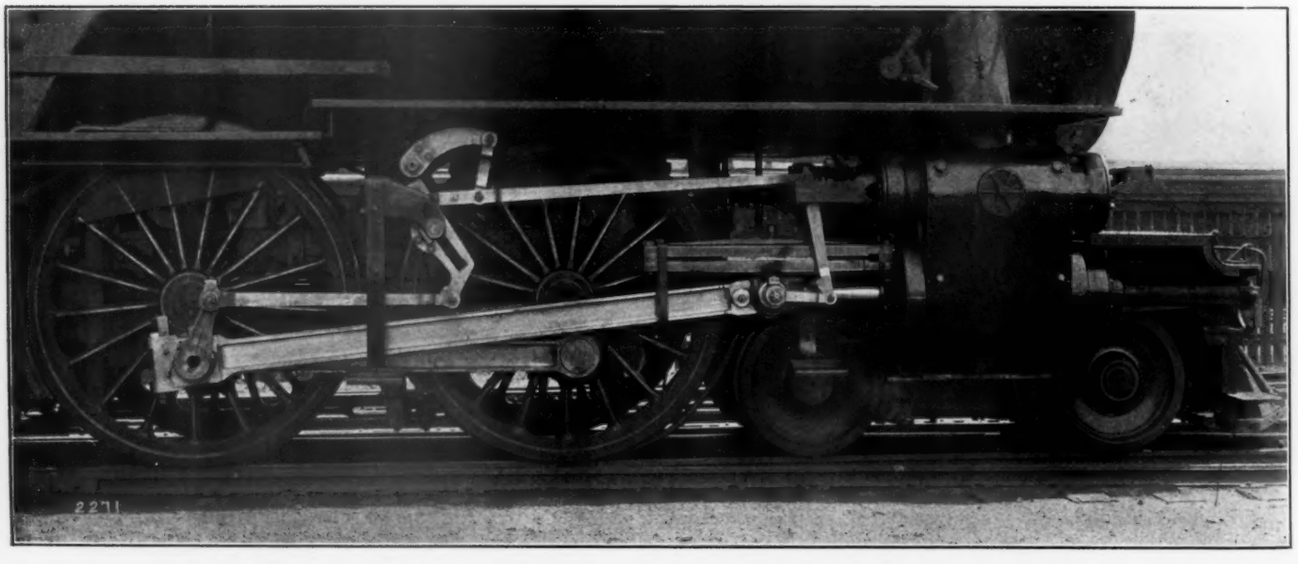
Section of Screw Reverse Gear

is the piston rod. This is of the extension type, and is of hollow, heat-treated steel. Much ingenuity was shown in working out the method of producing this unusual form of rod. One of the illustrations shows the rough forging which is drilled for its entire length of over 8½ ft.

The ends of the rod and the piston fit are then pressed down to the smaller diameter in a hydraulic forging press, as is shown in the second illustration. A photograph of a section of the finished rod is impressive evidence of its lightness and strength.



Valve Gear and Motion Work of the Pennsylvania Class E6s Locomotive



View Showing the Light Weight of the Parts of the Valve Gear and the Small Crosshead

The crosshead on the extension rod is cylindrical and arranged so that four bearings may be utilized. By removing a heavy washer and pin and turning the crosshead one-quarter of a revolution on the rod, a new surface is obtained at the bottom. The piston is a steel casting with cast iron rings. It is of the *Z* section and exceptionally light when its diameter is considered. The rings are joined by phosphor bronze segments, and the piston rod is locked by means of a thin plate washer, the edges of which are turned up.

When it is understood that the piston, piston rod and key complete on one side of the engine weighs but 402½ lb., it will be seen that success has been obtained in the effort towards extreme lightness.

The same care and study in the design of the crosshead has accomplished equally pleasing returns. This is probably the smallest and lightest crosshead ever applied to a locomotive of this size, and an inspection of the illustration will show its details. It will be noticed that a three-bar guide has been adopted.

An inspection of the ratios indicates that this locomotive will probably be somewhat slippery and the necessity for an easily operated and accurate adjustable reverse gear is easily understood.

The crank pins are hollow, of heat treated carbon steel, and, while the bearing surfaces are very large, the pins are light in weight. The methods of riveting over the inside of the pin after it is placed in the wheel center is shown in the illustration.

Heat-treated steel is used for the main and side rods and the axles as well as the crank pins and other parts of the motion work. Attention should be called to the exceedingly light crosshead which is carried in a three-bar guide. This crosshead is but an example of what can be done with this part when the possibilities of making it light in weight are carefully studied. The crosshead in this case with pin complete weighs but 312 lb.

TENDER TRUCK

A new form of solid frame pedestal truck has been designed for the tenders of these locomotives. This truck has a most substantial side frame which is made either of a steel casting or can be forged. A heavy cast steel transom is securely bolted to the frame. It will be noted in the illustration that each journal box has two yoke spring hangers supporting coiled springs, one on either side of the pedestal. The pedestal is provided with spool binder, and also has wearing plates, which can be removed, on either side of the jaw. This truck is, of course, considerably heavier than the usual type used under tenders, but its riding qualities are greatly improved, and its strength is beyond question.

These locomotives were designed throughout in the mechanical engineer's office at Altoona, and were built at the Juniata shop of the Pennsylvania Railroad.

The general dimensions, weight and ratios are given in the following tables:

General Data

Gage	4 ft. 9 in.
Service	Passenger
Fuel	Bit. coal
Tractive effort	29,427 lb.
Weight in working order	240,000 lb.
Weight on drivers	133,100 lb.
Weight on leading truck	55,000 lb.
Weight on trailing truck	51,900 lb.
Weight of engine and tender in working order	398,000 lb.
Wheel base, driving	7 ft. 5 in.
Wheel base, total	29 ft. 7½ in.
Wheel base, engine and tender	63 ft. 10½ in.

Ratios

Weight on drivers ÷ tractive effort	4.52
Total weight ÷ tractive effort	8.15
Tractive effort × diam. drivers ÷ heating surface*	599.00
Total heating surface* ÷ grate area	71.30
Firebox heating surface ÷ heating surface*, per cent	4.93
Weight on drivers ÷ total heating surface*	33.80
Total weight ÷ total heating surface*	61.00
Volume both cylinders, cu. ft.	13.10
Total heating surface* ÷ vol. cylinders	300.00
Grate area ÷ vol. cylinders	4.21

Cylinders

Kind	Simple
Diameter and stroke	23½ in. x 26 in.

Valves

Kind	Piston
Diameter	12 in.
Greatest travel	7 in.
Outside lap	1 5/16 in.

Wheels

Driving, diameter over tires	80 in.
Driving, thickness of tires	4 in.
Driving journals, main, diameter and length	9½ in. x 13 in.
Engine truck wheels, diameter	36 in.
Engine truck journals	5½ x 10 in.
Trailing truck wheels, diameter	50 in.

Boiler

Style	Belpaire
Working pressure	205 lb.
Outside diameter of first ring	78½ in.
Firebox, length and width	72 in. x 110½ in.
Firebox plates, thickness	⅜ in. & 5/16 in.
Firebox, water space	5 in.
Tubes, number and outside diameter	242—2 in.
Flues, number and outside diameter	36—5⅜ in.
Tubes, thickness	⅛ in.
Flues, thickness	.148 in.
Tubes, length	15 ft.
Heating surface, tubes	2,660.5 sq. ft.
Heatinug surface, firebox	195.7 sq. ft.
Heating surface, total	2,856.2 sq. ft.
Superheater heating surface	721 sq. ft.
Grate area	55.13 sq. ft.
Dome, height above rail	180 in.
Center of boiler above rail	9 ft. 10 in.

Tender

Tank	Water bottom
Wheels, diameter	36 in.
Journals, diameter and length	5½ in. x 10 in.
Water capacity	7,000 gals.
Coal capacity	13 tons

*Equivalent heating surface = 3,937.7 sq. ft.

DEVELOPMENT OF YOUNG MEN IN RAILROAD WORK*

BY GEORGE M. BASFORD

When asked to present this subject on this occasion I hesitated because to treat it in the right way puts me in the already too numerous class of critics of railroads. I decided to decline. Then it was urged upon me as a duty to help the railroads by telling the truth as I see it. With a sincere desire to show the way out of a great difficulty these observations are offered. They are offered to all the railroads of the country and not specially to those in this section. They are equally applicable to commercial and manufacturing organizations which have grown rapidly to large size and have, like railroads, neglected to provide the men of the future.

A fine orchestra is one of the best examples of successful organization. Each individual member has perfected himself in one particular part. His entire effort in life is devoted to the skillful performance of his own instrument so that it will take its place with all the others at precisely the right time, with exactly correct pitch, volume and expression. Every individual member is an artist, a master, and with his instrument he constitutes a perfect unit. Each unit is a necessary part of the whole. The omission of a single one would be detected by a competent critic. The work of such an organization is perfection itself. No one makes a mistake. Every sound goes with and into every other sound. Nothing is superfluous. There is no waste, no lost motion, no inefficiency. There is no dominant instrument. None stands out in relief against the rest. All blend into perfect music under the direction of the leader, whose slightest wish is instantly interpreted by every member. The leader is a part of every individual and every individual, in turn, is a part of the leader. This is an ideal organization.

This perfection of performance is not accidental; it is the result of unremitting training, first individual and then collective. It is worth while asking what railroad organization may learn from the orchestra. Railroads may learn from the orchestra the meaning and the importance of this word "training." If some years of study of the personnel of railroads has guided

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my thought correctly, railroads will find themselves unable properly to cope with their problems if they do not seriously and consistently inaugurate systems of training.

My subject is the "Development of young men for railroad service." To this should be added the same words in reverse order—"Development of railroad service for young men." I desire to present these two principles. If the best people of any kind are wanted anywhere the surroundings must be made attractive and kept so. Ask yourselves what are the inducements for your son to go into railroad service. Do you wish him to go into it? Are you doing what you may to make it attractive for him? Are you doing the right thing by the young men you now have in service? If you were to start over again, as a young man would you take up railroad work? These are pertinent questions, all of which will be readily and satisfactorily answered when the complete significance of the word training is understood and its principle is grasped and acted upon by the managements of railroads.

It is impossible to understand how the railroads of this country could have shamefully neglected apprenticeship as they have done. This is the industrial equivalent of ceasing to propagate the human race, and leaving the earth to beasts and vegetation. It will leave the mechanical trades to those who have been properly called "wreckers and rag-time mechanics." You are paying a ruinous price for this neglect today, and with worse to come if you do not wake up to the situation facing you. The few roads which are alive to it are like the taper light you carry in the Roman catacombs which makes the darkness the more impressive. What is a paltry group of twenty-five hundred boys provided with modern apprenticeship among seventeen hundred thousand men on our railroads! And yet you all take apprentices and solemnly swear that you will faithfully teach them the trades of your shops. You do not do it. You are actually dishonest with the boys. You do not even provide means for selecting them or of ascertaining whether or not they are adapted to the work you have undertaken to teach them. When they have served their time, if you give them full mechanics' wages you do it too late or too grudgingly and you promptly and properly lose the boys. The management then concludes that apprenticeship is a failure and it lapses into a dead letter. Not until self-preservation compels you will you give to the training of youth its proper place. Take warning. This point has been reached.

What training does the shop man receive today? I recently asked a railroad official how, in the absence of apprenticeship, he trained machinists. He replied—"We make them overnight from anything with two hands that comes along." It is no wonder that difficulty is found to put up a crosshead fit for a piston rod properly, or even to take one down without injuring it. It is no wonder that our locomotives carry around tons of unnecessary weight, because it is impossible for the shops to take advantage of the best engineering design. Is it possible for this railroad official to make mechanics overnight to take the places of his best men who have gone to the automobile industry? It is not and he knows it.

No matter how efficient or how well managed the mechanical department may be, no matter how well designed or how well maintained your locomotives are—the power must be used to best advantage and herein lies the field of most promise for effective training. Why not make common cause of a common problem in all departments and work it out together? Here is the greatest possible opportunity for co-operation, for a getting together, for co-ordination of effort.

Mechanical and operating officials have everything in common as a problem. Each knows much that the other needs to know. They are too far apart. I believe they may be brought together through training which will produce railroad men and not department men. What a field does the railroad present for progressive advancement and for a study of men to assure absolute certainty of advancing the men most capable of dealing with greater responsibilities! But the promotion is not properly balanced. Who ever looks to the motive power department today for a division superintendent, a general superintendent, a purchasing officer or a general manager? The few exceptions on record simply prove the rule. Why should a mechanical department position disqualify a good man for promotion? But it does.

This is the department that brings in the money, because the locomotive earns every dollar that comes into the treasury. Furthermore, if your power is always ready for 100 per cent service, the rest of the operating problem is relatively easy. It must also be admitted that roundhouse, shop and locomotive service offer opportunities to prepare most thoroughly and most admirably for operating responsibilities. It seems fair to assume that an operating officer who first thoroughly understands the possibilities and the limitations of locomotive service and then acquires operating experience will have certain advantages over an operating officer who has grown up only in the operating line from the telegraph key or from train or yard service.

I contend that the efficient service of a master mechanic should be considered as the basis for promotion not only inside but outside of the department. In other fields a man who can maintain and operate 200 locomotives making 2,000 turntable movements every week and do this with but 1 per cent of engine failures in winter storms, would be recognized and rewarded. He has 200 individual complete power plants on wheels and scattered, to care for and keep in perfect condition. These 200 locomotives represent perhaps $4,000,000 invested, not to mention investment in shops, coaling stations and roundhouses, and they aggregate 300,000 h. p., which is a greater aggregation of power than is concentrated in the New York Edison Waterside electric power station in New York City, the largest power plant in the world, and yet this master mechanic is likely to receive less compensation than a locomotive engineer who has a favorable run and, furthermore, he is not sufficiently encouraged by the prospect of promotion. The development of men for railroad service would be much easier if this man could be so encouraged, because it would render mechanical positions more attractive. It would cost the railroads and the public nothing to open the door for these men. A little prospect for advancement would go a long way to lead them to overlook deficiency in compensation, if compensation may not be increased.

Consider how roundhouse foremanship is misunderstood, how it is misused. Too little consideration is given to this important official, yet if he is a good one and can keep his locomotives moving under adverse conditions, for example in cold weather, he must necessarily exercise qualities of the character that make a general manager. If there is a position on the road that ought to be considered as a stepping stone to a better one it is that of the roundhouse foreman. Ask yourselves whether you would like to be a roundhouse foreman under conditions prevailing on most railroads today, with machinery, men and facilities lacking. Ask yourselves the reason. If you have ever seen a motive power officer promoted to the position of general manager you have seen roundhouses built and equipped so that men could do efficient work in them with money made thereby and you have seen good roundhouse foremen promoted. You have also seen these men give a good account of themselves. The roundhouse foreman can never have his job sweetened enough to be comfortable because of its inherent hardships, but if effective service should be recognized as a basis for promotion and the roundhouse made a stepping stone in a system of training for something better, an important part of this paper need not be written. Training must not stop with so called young men. Training, as I see it, involves the use of one position as preparation for a better one, and therefore should be an established principle in promotion.

We often hear how difficult it is to find foremen of high quality for various shops. Apprenticeship is the remedy, but not until foremanship is understood, not until the foreman is paid

at least as much as an active pieceworker in the shop. Foremanship does not attract the best shop men today.

Much complaint is heard of the difficulty in securing good firemen. Whom do you try to secure and who selects them? It was surprising to hear a railroad official make this statement before the Western Railroad Club recently: "It is too bad that in some cases men have been hired as firemen by the clerk of the road foreman. In other words, a man untrained has been permitted to select the man on whom you must depend to pull your fast trains 15 or 20 years hence." Of course this is exceptional, but that it ever occurs is important in this discussion.

An occasional strong, ambitious lad who had served his apprenticeship in the shop, would seem to be the very best candidate for this service. You would have known him for several years. The pay would attract him and he would take up the work with thorough knowledge of the locomotive which few young firemen now possess. An apprenticeship for firemen, however, is needed to take care of the other recruits for this service because comparatively few could be had from the shop boys. It is easy to imagine that a shop apprentice who becomes a fireman and then an engineman might reveal executive ability justifying his promotion to the position of traveling engineer or roundhouse foreman—but can he afford to be promoted after running an engine? We therefore see that progress here is blocked as it is for shop men as to foremanship. No one can doubt that here is something to be changed before improved methods of recruiting and training will be effective.

To return for a moment to the shop and directly to apprenticeship, ask yourselves where the boiler maker foremen and the boiler makers of the future are to be had. How many real boiler makers are you training? Boiler work constitutes the larger part of locomotive repair expense, and yet who has any boiler shop apprentices? Even the roads having the best apprenticeship schemes have very few of them. What are you doing about this to attract boys of the right sort to this vitally important trade? The right sort of boys will not take their chances in a boiler shop today. You yourselves would not. For the best of reasons you would not willingly allow your sons to do so. Look to this quickly. I warn you.

Someone asks what apprenticeship should be. The apprentice problem is very simple. For the shop it should be the old time apprenticeship brought down to date, changed and improved to meet present conditions. Several essentials must be provided.

First is the training of the hand, eye and judgment in the shop by men who have no other duties. The course should be short, active and thorough to render the boys good, quick, accurate and intelligent workmen, and good citizens, in the shortest possible time. Three years of intensive training is sufficient for the course itself. The shop training must replace the "master" of the past by a bright shop instructor who will personally teach the processes of the trade he himself commands and who will see to it that the boys of other trades are properly and consistently taught by competent men and methods. The boys must be taught direct and correct methods, and they must understand the value of time and material. This part of the subject merits a paper by itself.

Second is mental training coincident with the manual development. This means night schools or day schools conducted by men who understand the shops and who can show the boys how to educate themselves. These schools are to unfold the reasons for everything done in the shop and to lead the boys to look back at preceding processes and ahead to the processes which are to follow and to enable them to understand the materials, processes and forces with which they are dealing and to conduct their work without waste of energy, of time, or of material. Few men in the shop think of the cost of the work they do. If they did they would effect great savings. This is an important part of the school work. Boys in a year may know many things that their foreman required many years to learn and which some foremen have never learned. For instance, our boiler shop apprentice will know how to design boiler seams. I know of a capable foreman who recently reduced the strength of a joint below safe limits believing that by putting in a surplus of rivets he had made a strong repair job.

Third and most important is the personal responsibility over the boys centering in one man, the apprentice supervisor, whose duty is to know and understand them. He must know the boys intimately, thoroughly understanding their capabilities and their personalities. He must know them better than parents usually know their boys and be able to guide them in all the affairs of young manhood. He must know them well enough to guide them into the right work, and he must have natural ability as an educator so that he can deal with each personality in accordance with its peculiar needs and its own peculiar possibilities. This man must know the essentials of the makeup of a machinist, boiler maker, pipe fitter, millwright, pattern maker, carpenter, fireman, clerk and all the rest. With this knowledge and with great care he must help the boys select their work and guide them in such changes as may be necessary. He must be able to adjust misfits which are sure to be found and must interest all the foremen in the boys. He must also be a man of high moral character, one with a personality that will enable him to influence the boys and lead them to be honorable, upright men. He must have that enthusiasm that makes work of any kind successful. He must reveal to the lads their duty to themselves and to the country. A good citizen is likely to be a good workman, and a good workman is likely to be a good citizen. You will say that these specifications are very severe and that it is difficult to find such men. The answer is that the fact that it is so difficult to find such men in itself reveals the weakness of present methods and the need for an awakening. The man who can do such work properly and who can exert this influence continuously will prove to be one of the most important subordinate officials of the whole railroad organization. A few such men are available and more are coming along.

An objector says: "We can't afford to play into the hands of the unions. Our apprentices joined the unions and we fired them." Life is too short to answer this except to ask whether anybody is seriously attempting to improve unionism. Some are saying that the labor union agreements limit the number of apprentices. The answer is that the railroads should not raise this question until they have made proper provision for the number that the agreements allow. The quickest way to increase the allowance is for a labor leader to discover that his son can not be apprenticed because the ranks are full up to the limit he himself has helped to fix. Some one else is saying that it is difficult to secure boys of the right sort in sufficient numbers. This is completely answered by the roads which have taken this subject up with serious intent. There is no trouble to find the boys. Some one will add that the red tape surrounding the employment of minors is so irksome that they cannot afford to put up with it. You will be held to account if you allow this to stop you. Another will say that small shops can not properly provide for apprentices and that poor roads can not afford apprenticeship. Both objections are absolutely silly, as has been proven by experience. You can not introduce anything in any shop or any department that will pay as big or as quick returns as will apprenticeship when it has the force of the management back of it. After the first year the boys pay back to you all you spend on their education or your system is at fault. Let me say again that failure to provide apprenticeship is not to be excused on any ground whatever.

Your office is not what it should be, neither is your shop or your drawing room if it leads to blind alleys from which there is no promotion and no outlook. You must find outlets, or the equivalent, for capable men in every department. If not outlets then you must find ways in which able men may so improve their work that they will not cease to grow, expand and become more valuable to the company and to themselves. Rail-

roads and industrial concerns are not thinking of this today!

We must take a leaf from the book of English roads. English motive power men do not quit as ours do to double their salaries in the service of industrial concerns, in positions where they are not worried to death by troubles that they know how to prevent, but are not allowed to guard against. On the larger English roads the chief mechanical officers receive salaries approximately twice as large as the largest in this country. On some English roads the chief mechanical superintendents deal not with officers who do not understand them and their problems, but with committees of the directors of the roads. No wonder those mechanical officials remain in the service until relieved upon retirement. No wonder subordinate officials are willing to spend their lives hoping to succeed to such positions.

Today the locomotive and its operation offer greater possibilities for improvement in net earnings than ever before in the history of railroads. Today the locomotive presents problems as well as possibilities requiring knowledge, experience and good judgment that were never required before. Today is the day for improvements in the use of fuel, for fuel saving devices and capacity increasing factors in locomotive design, for improvement in service and for improvement in equipment and methods for maintenance, and for the training of the men of the future. Will the railroads measure up to their opportunity? Will they? An entire evening would be required to tell of the accomplishments in improving locomotive service in spite of unfavorable conditions. What would the results have been with favorable conditions!

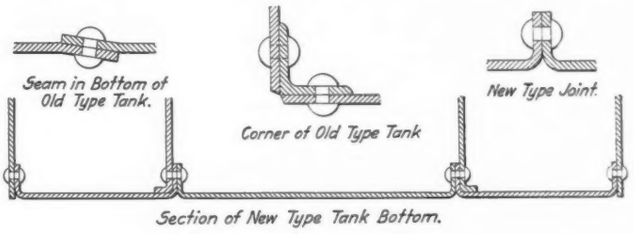
Apprenticeship has made good where it has had half a chance, and it has had a chance on a few progressive railroads. It is not a failure. Its value is established beyond a question. The only failure has been a lack of backing. The only trouble has been in educating the managements to what they ought themselves to know to be their duty. It is fruitless to start apprenticeship unless the very head of the organization plants himself squarely for it, insisting that every one get in line and stay there. If he does this no subordinate will dare ignore it, simply because he is looking only for the things of today. The world will not long excuse neglect of apprenticeship and that which goes with it, and this applies to every department.

THE SINGLE-DRIVER LOCOMOTIVE.—In spite of all that has been done in developing the locomotive on British railways there is only one type of engine which can as yet be regarded as really obsolete, viz., the single-driver passenger locomotive, the construction of which has now been entirely discontinued. The introduction of heavier and more complicated types has not, up to the present, had the effect of retiring any of those which formed the contemporaries of the single-wheeler when the latter was at the height of its popularity, although the 2-4-0, which is only one remove from the single, is no longer a type which would be built for any but the lightest service. The basic feature of coupled driving wheels in any form presents facilities for employing adhesive weight in a degree which cannot be realized where there is only one driven wheel, and this fact exercises a sufficient influence, even now, to keep many types of locomotives still within the ranks of present day standards, where they are regarded, in most cases, as being suitable, within their various scopes, for modern railway conditions. It is simply and solely this difficulty of providing adequate cohesion that has driven the single-wheeler out of favor, for there is no class of railway engine which can compare with it for economy and freedom in running. There is nothing to hinder the fitting of large boilers and cylinders to this type, but merely to provide a higher tractive effort without its being possible to utilize it without slipping the driving wheels, would serve no useful purpose and would, moreover, emphasize the need for employing coupled wheels even more decidedly than at present.

LEHIGH VALLEY TENDER TANK

An improved construction in tender tanks has been developed by F. N. Hibbits, superintendent of motive power of the Lehigh Valley, and is now standard on that road.

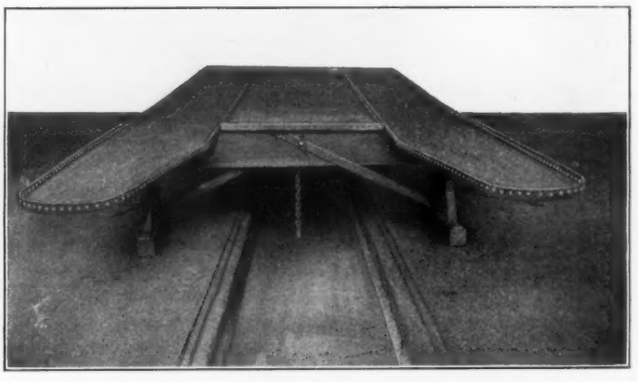
The new construction comprises chiefly the use of flanges on the top and bottom sheets for the connection with the vertical



Section of New Type of Tender Tank

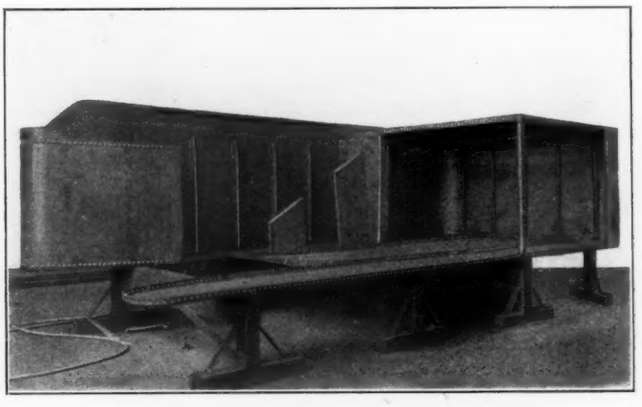
sheets, in place of the customary angle iron. The flanges are turned into the water space and all rivets are horizontal and accessible from the interior of the tank. The new method of forming the different joints is evident in the illustrations.

This construction has proved to have a number of advantages.



Bottom Sheets of Tank Showing Form of Flanges

In the first place, all rivets and rivet holes are eliminated from the bottom of the tank, and it is possible to remove loose rivets and tighten leaky joints without removing the tank from the underframe. Furthermore, it is found that the tank bottom has an increased life due to the absence of lap joints, angle irons and



New Type of Tender Tank Partially Erected

rivet holes. The construction is stronger and simpler, and the tank is cheaper to manufacture and also gives a reduced cost for maintenance. Standard sections can be carried in stock.

The Lehigh Valley now has about 110 of these tanks in service, the first of which has been in use over two years.

College Men in Railroad Work

Discussion of Conditions That Make This Field Unattractive and Suggestions for Improvement

BY M. K. BARNUM
General Mechanical Inspector, Baltimore & Ohio

Comparatively few graduates from engineering colleges enter and continue in railroad service, especially in the mechanical department, where we would naturally expect the attractions and opportunities to be the greatest. Is the trouble with the men themselves, and their habits of mind and life? Is their college training at fault? Is it the lack of satisfactory opportunities in railroad work, or is it the experiences of other men who have tried it, that discourage them from entering railroad service?

IS THE TROUBLE WITH THE COLLEGE MEN THEMSELVES?

College men are not inherently different from other men, but, on account of their better education, more is expected of them than of those who have had only a common school education, and properly so, but is it fair to expect that even 50 per cent. of them will be capable of holding high official positions, when less than one per cent. of other railroad men are found competent to fill such places? I maintain that it is not reasonable to expect that every college man who enters railroad service will have all of the qualifications necessary to make a first-class superintendent of motive power, when less than one in 5,000 other mechanical department men ever becomes fully qualified to fill that position, and not more than one in 1,000 ever makes a thoroughly competent master mechanic.

IS THE TROUBLE WITH THEIR COLLEGE TRAINING?

I believe that the mechanical engineering courses in the best equipped universities, such as Cornell, Illinois, Purdue, Massachusetts Institute of Technology, Stevens' Institute, and a few others, furnish about as good preparation for railroad mechanical department work as can be desired or expected. In fact these courses provide the very best of training for such work, particularly if the student specializes in railroad subjects during the last year or two. It cannot reasonably be expected that a mechanical engineering college will turn out a graduate equipped to step into such a position as that of master mechanic, or even a foremanship, without having considerable practical experience, which can only be obtained in actual railroad service, but an engineering course will enable him to qualify much sooner for such positions than is possible for a young man who has had but a common school education and an ordinary apprenticeship. The mechanical engineering course in the above-mentioned colleges gives the student considerable practical work in the foundry, pattern making, forging, running machines, such as lathes, planers, shapers, etc., and some of them devote a good deal of attention to the principles of efficient shop management. If I were to suggest any change in the present mechanical engineering schedules, it would be that some of the higher mathematics, which are now required, should be made elective for those who wish to specialize in them, and thus allow others a little more time for such subjects as political economy, history, and possibly a short course in law pertaining to contracts and some other important items of business. These subjects would furnish fully as good mental training as the higher mathematics, and might be more useful to the average engineering graduate.

It is also important that men of practical experience in railroad and other engineering work should be secured to give lectures to the upper classes, explaining to them the advantages, possibilities and difficulties found in various lines of engineering. This plan is now followed to some extent, but a more complete and systematic program of such lectures should be provided. Every student should also try to meet men in the lines of business which they are considering, and obtain their views and experience, but this is not always easy or possible for the student to do, especially where a college is located away from manufacturing and railroad centers.

IS IT THE LACK OF SATISFACTORY OPPORTUNITIES IN RAILROAD WORK?

I believe that this is the principal reason why so few engineering graduates enter railroad service and continue in it. Beyond question the railroads need college trained men, because the requirements of roundhouse foremen, general foremen, master mechanics and superintendents of motive power are daily becoming more exacting and strenuous, and, to properly understand and administer the duties of those positions, a man should have more than a common school education. With the increasing necessity for making a dollar go farther than ever before, and with the constant additions of electric and other complicated apparatus to locomotives, cars and shop equipment, an engineering education is very helpful, and will soon become a necessity.

All railroads are short of material from which to make competent foremen and other officers, and yet mechanical engineering graduates are avoiding railroad service. What is the trouble? I believe that the principal reasons are these:

(1) Advancement is slower than in commercial and manufacturing lines.

(2) The salaries are too low in proportion to the ability and responsibility required for official positions.

(3) The tenure of office is too uncertain on most railroads, although there are some exceptions to this rule.

(4) There is small chance for a railroad man to accumulate any property, or to do more than make a fair living for his family and give his children an education.

(5) There is no chance to acquire an interest in the business.

ARE THE EXPERIENCES OF OTHERS DISCOURAGING?

Very few sons of railroad officers take up railroad work. This is due primarily to the discouraging experiences of others whose careers they have observed, but also to the advice of the fathers, who believe that the discouragements are less and the rewards for ability and industry are greater in other lines of business.

The question has been asked, "Why should it be up to a busy railroad officer to tell a college man how to start in railroading?" My answer is that a part of the "busy railroad officer's" duty to his company is to secure the services of men who will become most valuable to the company, and to keep out of the service men who are not adapted to, or fit for it. How can an officer decide on a man's fitness, if he does not take the time and interest to discuss with him the opportunities and obstacles to be found in the work? Furthermore, every man, even though he be a "busy railroad officer," ought to consider it a privilege to be given an opportunity to help a young man decide on his course, and get started right in the race for success in his business career.

What are the experiences of the average mechanical engineering graduate? After spending four years in high school, and four years in college, or eight years more than the regular apprentice who has finished the graded schools, he finds himself, at the average age of 23 years, about to start work, but with very

little practical knowledge of the duties which must be performed in railroad service. Although he has had some experience in wood working, forging and machine work, he is expected to start as a special apprentice in the railroad shops at the rate of 15 or 20 cents an hour, which does not enable him to earn enough to pay his board and lodging, and is about half what he can earn in many other lines of work. But few railroads have special apprentice courses, and most of those are handled in a haphazard manner. As a rule the special apprentices are not given the proper training by the railroads to equip them for the places which are to be filled, and through which they must advance to one of the few higher positions that are really worth trying for. Sometimes they do not get fair treatment from the foremen, or even the master mechanics, and frequently the superintendent of motive power loses sight of them altogether. They are often kept on work with which they are already familiar, and not given an opportunity to learn the practical things which they must know before becoming qualified for advancement. Ordinarily, after a special apprentice has finished his three or four years' course, he is not qualified to fill the positions for which men are needed, especially those of roundhouse foremen, general foremen, etc. If the special apprentice spends two years on the right kind of work, he should be worth more than the average machinist that railroads hire when filling vacancies or increasing the force.

The special apprenticeship course should cover two years, with wages of about 25 cents an hour the first year, and 30 cents the second, although these rates might need to be increased slightly in some localities to conform with wages paid for other classes of work.

To properly qualify a special apprentice for further advancement, he should be given about the following line of work:

First year—Freight car repairs, 4 months;
Locomotive machine shop, lathe, 4 months;
Locomotive machine shop, planer or shaper, 4 months.
Second year—Locomotive erecting shop, 6 months;
Roundhouse, 3 months;
Firing a locomotive, 3 months.

It might be found advisable to shift the order, or slightly modify the proportion of these different classes of work, but, after having the above line of experience, the young man should be qualified to work as a machinist, and within a few months should be advanced to a position as assistant roundhouse foreman, or given some similar work which will put him in line for promotion to a position as roundhouse foreman or general foreman at a small terminal.

I consider it a valuable experience to work on freight car repairs, and I do not think it necessary for the engineering graduate to work in the boiler shop or blacksmith shop, as he will be able to observe enough of the methods of doing those kinds of work, while employed in other departments, to meet his needs, although of course not enough to qualify him for a position as foreman of a blacksmith or boiler shop. It is an injustice to the special apprentice to sidetrack him in a drawing office, or to hold him for more than a very short time on test department work. The roundhouse work and firing of locomotives are especially valuable in giving him some practical knowledge of running repairs and the conditions surrounding locomotive operation.

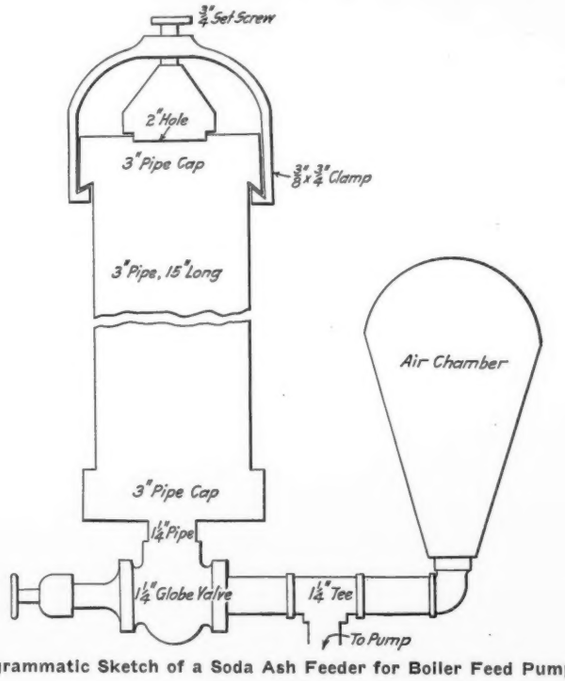
The question has been asked, "Why should the railroad have special courses, special apprenticeships and special studentships to take care of the college men?" The railroads do not have these courses "to *take care* of college men," but to help qualify them to be of most use to the railroad companies. The special apprenticeship is the best means yet found of securing and preparing men with an engineering education for positions of responsibility where they are needed, and this method is all right if it is intelligently planned and followed up. To be best equipped to handle men, one must have worked in the ranks, so as to learn the difficulties and viewpoints of the man who works by the hour.

There are misfits among college men, as there are among men of other training, and when a man who has entered railroad service is found to lack the requisites for this business he should be so advised and urged to try something else before he has wasted too many years in endeavoring to learn a business for which he is not fitted.

There are many attractive things about railroad work. Its variety, the interesting problems constantly arising to be worked out, and the "things worth while" which are always waiting to be done, all form incentives to the man of active mind and body to exert his best efforts in accomplishing good results; and it is the fascination of these things which holds in railroad service so many men who might make a greater financial success in other lines of business. However, the outlook for railroad officers today is in many respects discouraging, as there is an absolute certainty ahead of much hard, nerve-racking work, long hours and government restrictions, which are daily multiplying and are at times unreasonable and difficult to comply with. All these things tend to keep many good men out of railroad work, and I predict that in five, or at most, in ten years, there will be a greater scarcity of well educated and well trained men competent to fill master mechanicships and the positions of superintendent of motive power than ever before.

SODA ASH FEEDER FOR BOILER FEED PUMPS

In parts of the country where locomotive boiler troubles are aggravated by bad water it is also frequently necessary to provide means of introducing soda ash or some other substance in the feed water supplied to the boilers of shop power plants.



Diagrammatic Sketch of a Soda Ash Feeder for Boiler Feed Pumps

The accompanying diagrammatic sketch, which is self-explanatory, shows a device in use on a western road for passing soda ash through the feed pumps of stationary boilers. This has been in use for some time with satisfactory results.

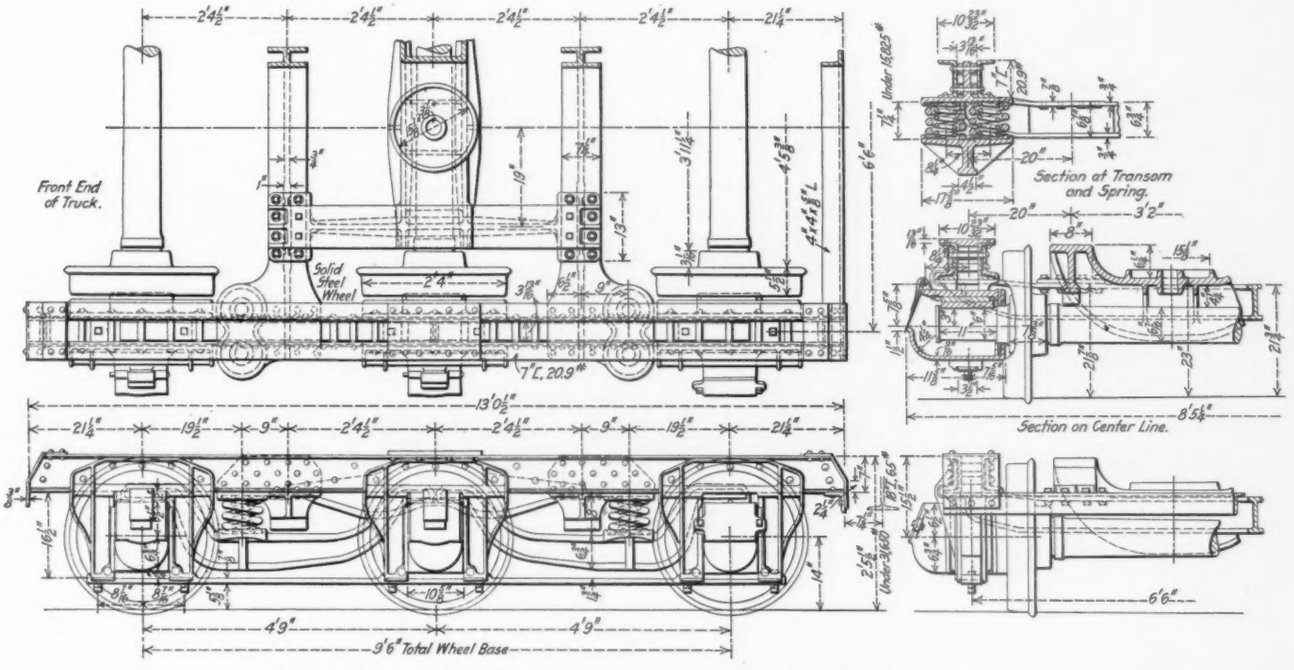
SPEED INDICATORS.—In many countries in Europe all passenger locomotives are required to be equipped with speed indicators, maximum speeds being specified by law over various divisions.—*Railway News.*

CAR DEPARTMENT

HIGH CAPACITY WELL CAR

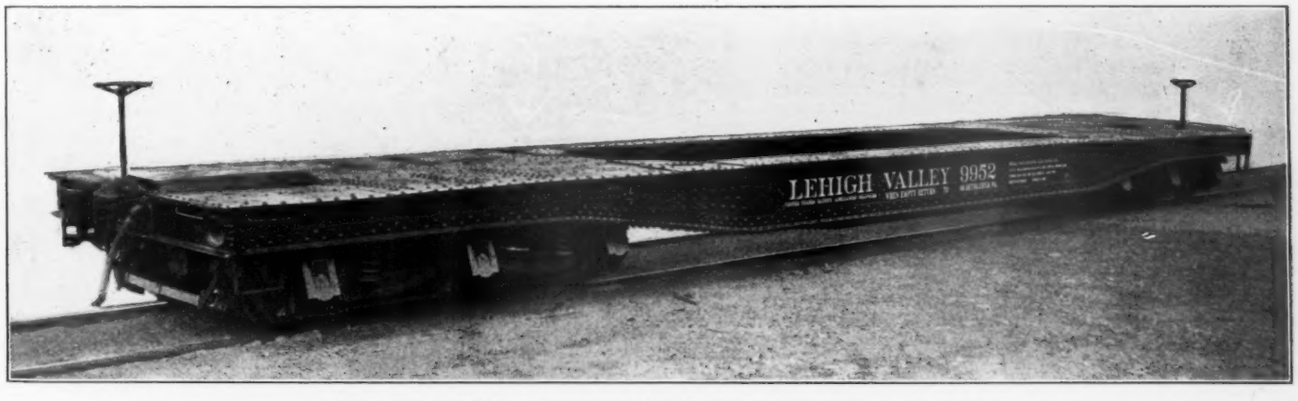
Three well cars which have a capacity of 220,000 lb. have been designed and built by the Lehigh Valley. They are intended to handle special shipments originating at the Bethlehem Steel Works, and are the highest capacity cars ever constructed. The include a slightly raised cover over the draft gear, but, with this exception, the floor of the car is flat.

For a distance of about 14 ft. 8½ in. from the end sill the floor is continuous across the width of the car and the structure in this part consists of a very heavy and rigid cast steel double body bolster in two parts and 12 in. 40 lb. I-beam center



Six-Wheel Truck with 28 in. Steel Wheels for 220,000 lb. Capacity Well Car

length over end sills is 55 ft. 7⅜ in., and the height of the floor above the rail level is but 38 7/16 in. It will be seen that the cars are exceptional in both of these particulars, as well as in their very high capacity. The design provides for carrying the full load concentrated at the center of the car. The well opening sills continuous from the end sill to the end of the well opening. The sills, at the inner end, are connected to an 18 in. 65 lb. I-beam which extends across the car in one piece between the side sills. Between this heavy cross member and the bolster there are two intermediate longitudinal sills consisting of 7 in.



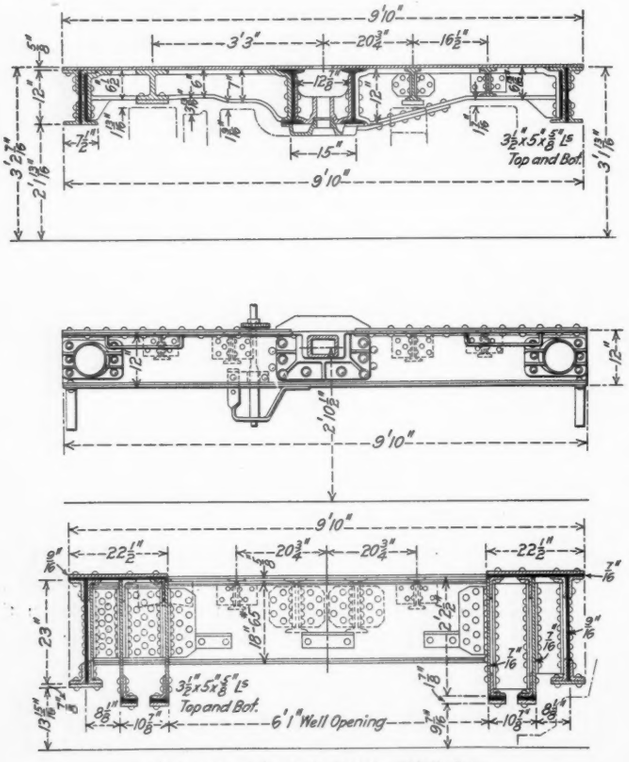
A Well Car Capable of Carrying 220,000 lb. Concentrated at the Center

is 26 ft. 2 in. in length by 6 ft. 1 in. wide and is unobstructed, except for the gusset plates at the corners.

As will be seen in the illustration, these cars are in the form of a regular flat car without pockets for side stakes and are of all-steel construction. The low floor has made it necessary to I-beams equally spaced on either side of the center sills. This is also true of the space between the body bolster and the end sills. The arrangements and connections of these members are shown in the illustrations. The floor plates on this section of the car are 7/16 in. thick in one piece for the full width, ex-

cept over the body bolster where the plate is 5/8 in. thick. The end floor plate is, of course, cut away for the clearance of the draft gear as is shown in the illustration.

The connection in the center of the car between the two 18 in. I-beams is unusually massive and strong, since it must be capable of carry the whole load at the center if necessary. As will be seen in the cross section this consists of three plate girders on each side. The outer one is a 9/16 in. web plate, 23 in. in depth at the center and is continuous between end sills. It has two 3½ in. by 5 in. by 5/8 in. angles at both the top and the bottom, and in addition a 7/8 in. bottom cover plate and a double floor plate at the top. Inside of this are two girders consisting of a 7/16 in. web plate which is 26½ in. in depth at the center of the car and 18 in. at the connection with the cross piece. Both of these girders have a single 3½ in. by 5 in. by 5/8 in. angle at the top and bottom and 7/8 in. bottom cover plates. These three girders are braced and stiffened by braces about 5 ft. apart. It will be noticed that there is a 5/8 in. reinforcing plate on the inside of the side sill extending from a point about 2 ft. 6 in.



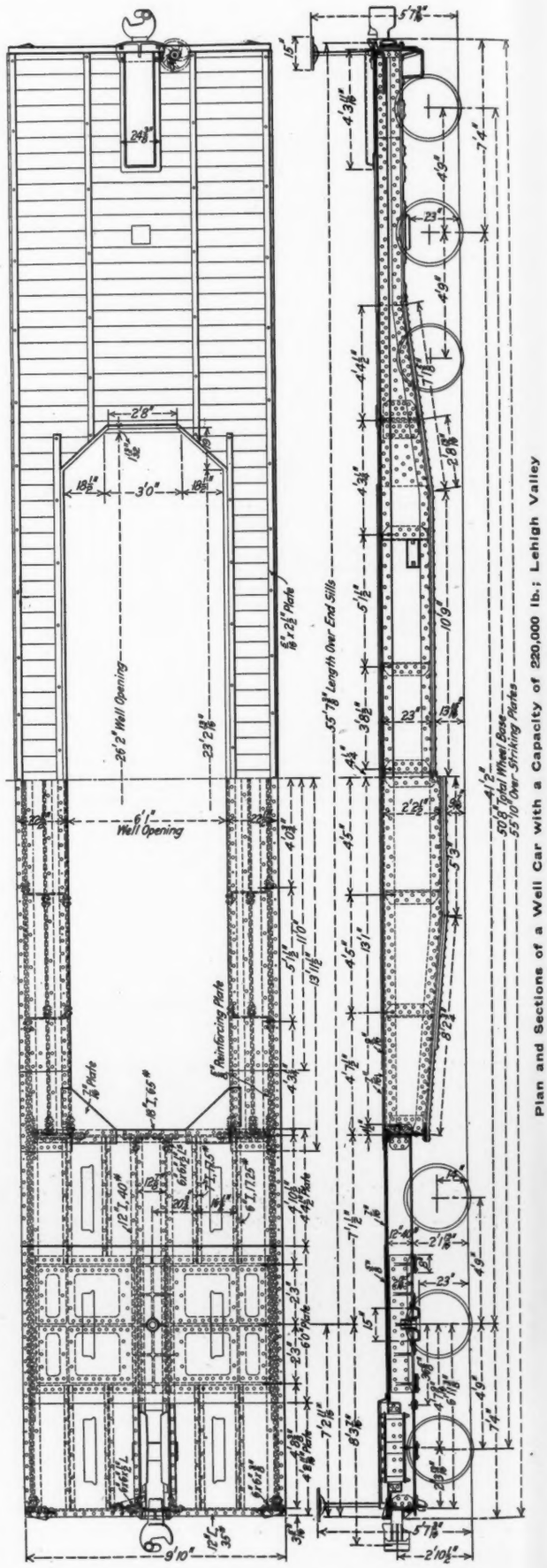
Sections of Lehigh Valley Well Car

inside of the well opening and continuous to a point about 1 ft. outside of the body bolster. This fits between the flanges of the angles on the side sills. The method of forming the connection between these various heavy members is well shown in the drawings.

In the plan view of the cars it will be noticed that provision is made for a wooden flooring which can be applied on top of the steel flooring if desired.

A desire to keep the total height of the car at the minimum distance led to the use of 28 in. solid steel wheels on the six-wheel trucks. The axles have 6 in. by 11 in. journals, and the arrangement of the framing is clearly shown in the illustration of the truck. It will be seen that it has been possible to obtain a center plate which is but 23 in. above the level of the rail by carrying the deep flanges of the truck bolster down on either side of the center axle.

This car has a total weight of 91,900 lb., and was designed in the mechanical engineer's office of the Lehigh Valley, under the direction of F. N. Hibbets, superintendent of motive power.



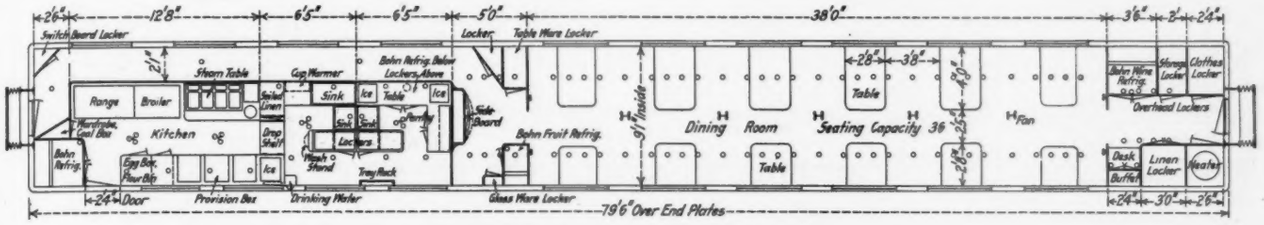
Plan and Sections of a Well Car with a Capacity of 230,000 lb.; Lehigh Valley

DINING CARS FOR THE BURLINGTON

The First Cars of a Design That Has Been Made Standard on the Chicago, Burlington & Quincy

With the government specifications for postal cars as a basis, the Chicago, Burlington & Quincy has drawn up specifications for all types of cars to be used in passenger train service. An effort has been made to have them as simple as possible and to establish standards that will provide the greatest interchangeability between all passenger train cars. All of the designs are, as far as possible, made up of structural shapes, and all special parts, such as pressed steel shapes, are made from standard dies so that when once designed they may have a wide range of use. A special effort has been made to eliminate the use of patented constructions so that the cost of royalties will be small.

The first cars built under these new specifications are the diners that have recently been furnished the road by the Pullman Company. These cars are 79 ft. 6 in. long over end sills and have no platforms at either end. By adopting this plan it has been possible to provide seating accommodation for 36 persons and to have a larger and more convenient kitchen. A side door 2 ft. 4 in. wide, opening directly into the kitchen, has been provided so that the car may easily be provisioned. The kitchen has been laid out according to the standard practice of the Pennsylvania Lines and is provided with all the latest improvements. The cars are of all steel construction, wood being used only in and about the windows, and in the flooring.



Floor Plan of the Burlington Dining Car

UNDERFRAME

The entire load between the bolsters is carried by the side construction, leaving the center sills to take care of the buffing and draft strains. To do this the cross bearers were made sufficiently stiff to transmit any load coming on the center sills to the sides of the car. The underframe is of simple construction and is made up mostly of steel shapes. All the pressed steel work serving similar purposes is made from one die and therefore at a minimum expense.

The center sills are composed of two 15 in. 35 lb. channels spaced 16 in. apart. They have a top cover plate 5/16 in. thick by 2 ft. 4 in. wide extending from end sill to end sill, and a bottom cover plate 5/8 in. by 2 ft., which only extends between the body bolsters. Both cover plates are riveted to the flanges of the center sills with 3/4 in. rivets spaced 4 in. apart. There are four cross bearers spaced 10 ft. 7½ in. apart in the central portion of the underframe. They are made up of two pressed steel pans placed back to back and riveted together. Each cross bearer is thus made up of four pressed steel pans, two of which extend from the center sills to each side sill, being riveted to the center sill by eight 3/4 in. rivets, and to the side sill by four 3/4 in. rivets. The outside ends are shaped to conform to the shape of the side sill. The top cover plates are 1/4 in. by 12 in., and extend from side sill to side sill, being riveted to the flanges of the steel pressings by 3/4 in. rivets spaced 3¼ in. apart; the bottom cover plates are 7/16 in. thick and 12 in. wide at the center sills and gradually tapering to 7 in. at the side sills. They also extend in one piece from one side sill to the other.

The double body bolsters have cast steel center fillers and are riveted between the center sill channels by 3/4 in. rivets. They are located 10 ft. 8¼ in. from the end sills. They have top cover plates 6 ft. by 1/4 in., continuous between the side sills, and are further braced by an 8 in., 18 lb. I-beam extending between them 3 ft. 9½ in. each side of the center of the car. There are ten 3 in. 6 lb. channels extending out from the web of the center sill to the side sill on each side of the car. They form the intermediate supports for the floor and the various equipment applied under the car.

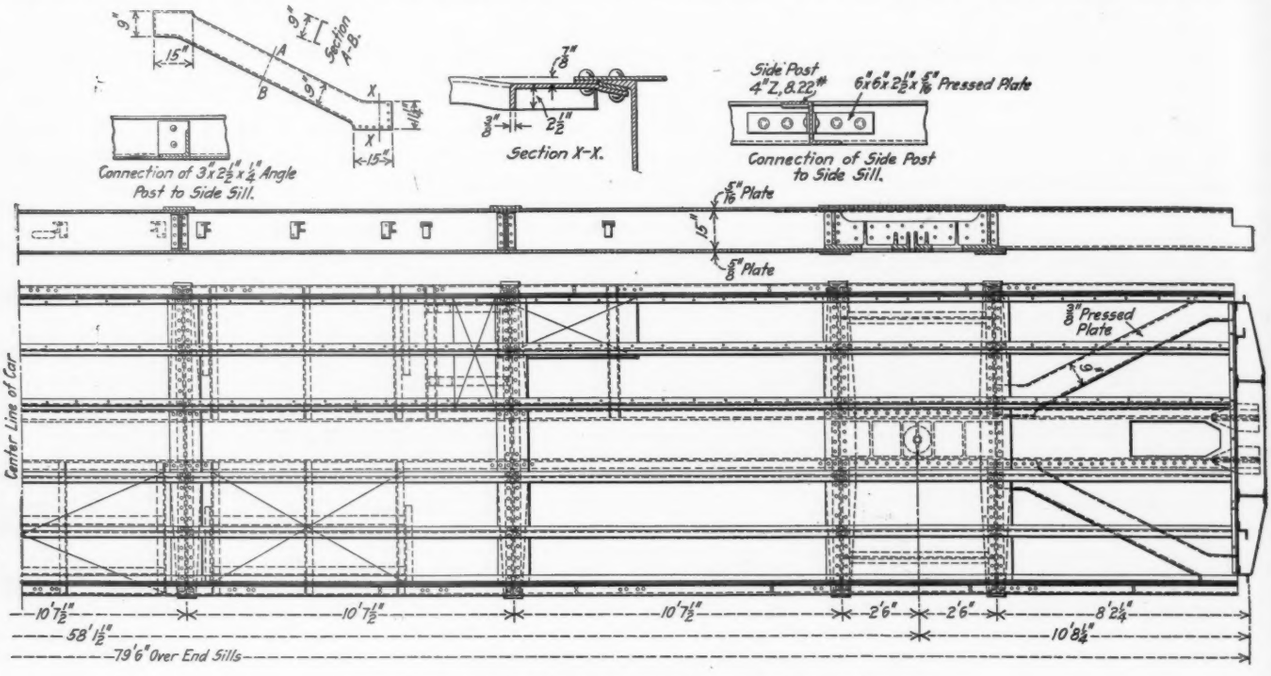
The side sills are made up of 4 in., 8.2 lb. Z-bars, and extend the full length of the car, being riveted to the cross bearers by four 3/4 in. rivets and thoroughly anchored in the end sills by angle gusset plates. The end braces are made of 3/8 in. plate, being pressed to the shape of a channel 9 in. wide and flanged out at the ends to make the connections at the corner posts and at the junction of the center sills with the cross bearers.

The end sill is made up entirely of pressed steel shapes and steel plates. A pressed angle 2½ in. by 4½ in. by 3/16 in. ex-

New Standard Dining Car for the Chicago, Burlington & Quincy

tends across the end of the car being riveted to the end bracing, the small pressed steel Z-floor beams and the center sills. A 3/16 in. plate 10¾ in. wide is riveted between this angle and a pressed shape made of ⅜ in. plate, and extends down to the bottom of the end sill. A second pressed shape of the same stock is located below the first and is riveted to the lower part of the 3/16 in. plate. A ½ in. by 6½ in. end sill cover plate is riveted to the outside face of these shapes and extends clear across the end of the car while the pressed steel shapes only extend between the corner posts and two vertical I-beams located 21½ in. each side of the center line of the car.

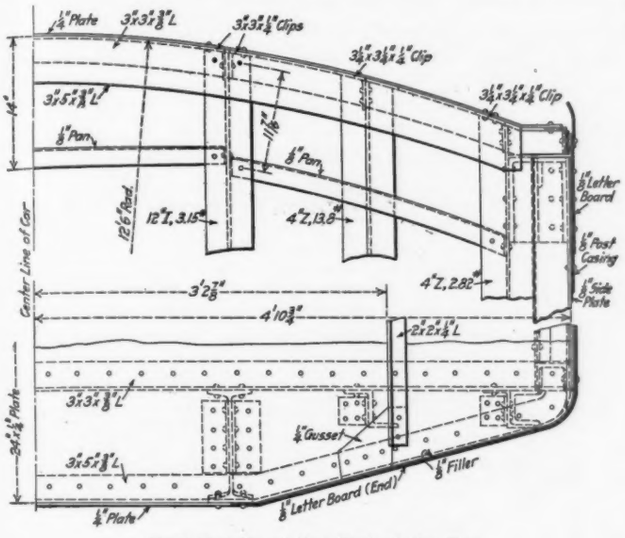
These I-beams are the point of greatest resistance in the end construction of the car, being 12 in. wide and weighing 31.5 lb. per foot. They are thoroughly anchored in the end sill and extend from the bottom of the end sill to the end plate at the roof, where they are again anchored in the superstructure.



Underframe and Details of the New Diners for the Burlington

Interior View of the Burlington Dining Car Taken by the Light from the Indirect Lighting System

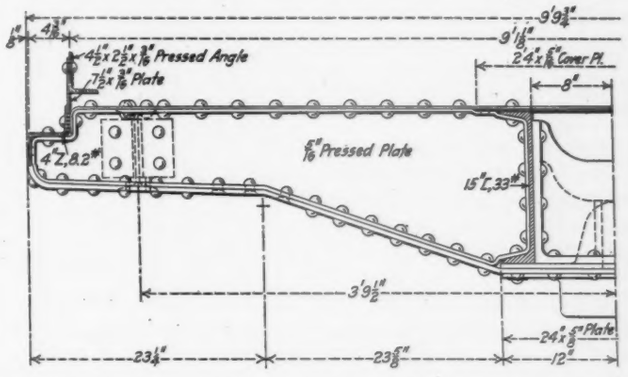
Further bracing of the car end is provided by two 4 in. 13.8 lb. Z-bars located 15 7/16 in. each side of these I-beams, and by the 4 in. 8.2 lb. Z-bars which form the corner posts. These Z-bars are anchored to the end sill at the top of the upper pressed



Roof Details at the End of the Car

steel shape by angle plates. This construction provides a section modulus of 72 in contrast to the government requirements of 65 for mail cars. This end is of a standard design and is

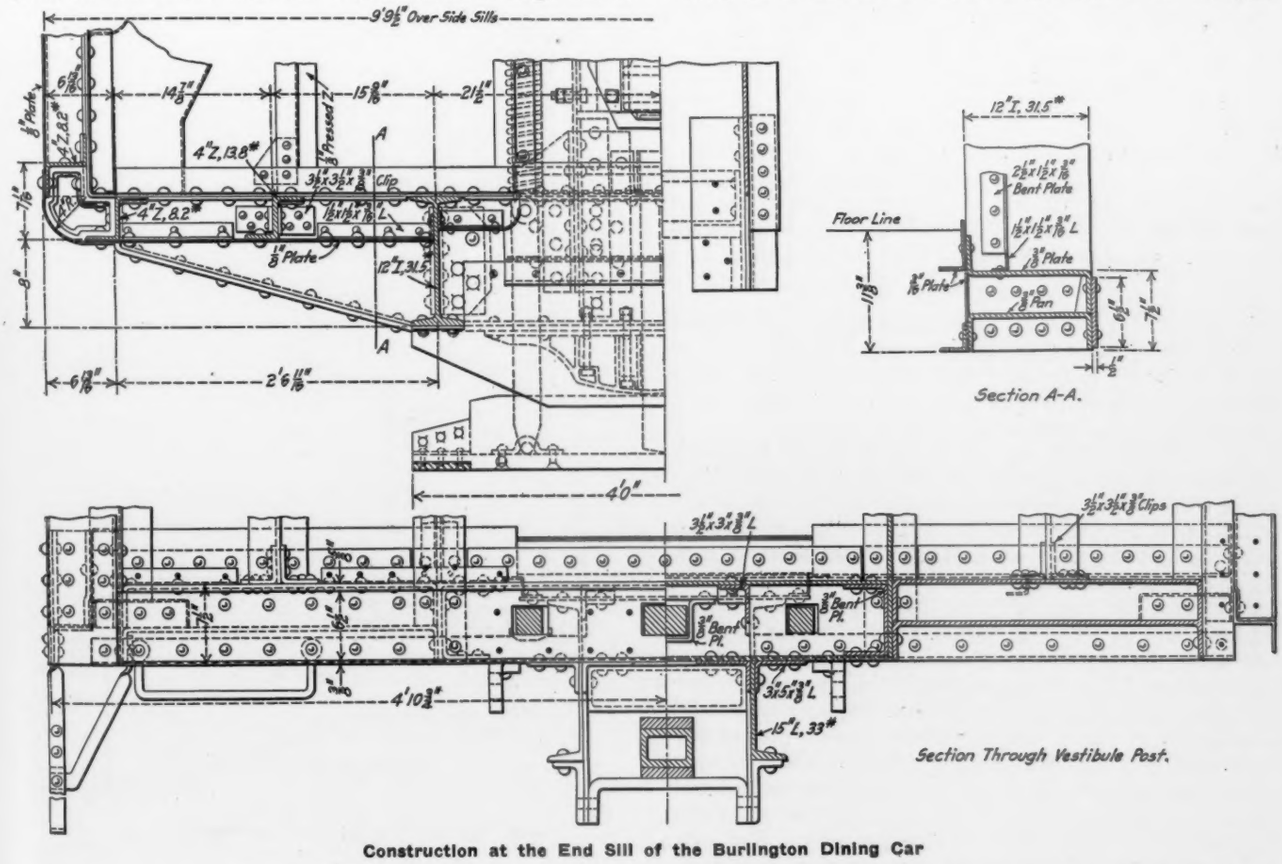
and dimensions. The side posts are continuous from the side sill to the side plate, being secured to the side sills by two 6 in. by 6 in. by 5/16 in. angles, and to the side plate by 3/16 in. gusset plates. The belt rail is made in sections extending between the side posts and secured to them by 4 in. by 4 in. by 5/16 in. by 2 in. angles above and below. There are ten 3 in.



Steel Pressings Are Used in the Construction of the Double Body Bolster

by 2½ in. by ¼ in. angle window posts on one side of the car and eleven on the opposite side, which extend from the belt rail to the side plate. The posts for the side door in the kitchen are made of 4 in., 8.2 lb. Z-bars. The side framing below the belt rail is stiffened with 3 in. by 2½ in. by ¼ in. angles.

There are 52 carlines for the lower deck and 26 for the upper



Construction at the End Sill of the Burlington Dining Car

intended to be used in all passenger equipment, even though built with a platform.

BODY FRAMING

The side framing of the cars is made up of eleven 4 in., 8.2 lb. Z-bar posts, and a belt rail and side plate of the same shape

deck, both of which are made of pressed steel shaped in the form of a channel. The lower deck carlines extend from the side plate to an equal number of pressed steel deck posts, also shaped in the form of a channel, which serve as a tie between the upper and lower carlines. The roof joint carlines are 2½

in. by 1¼ in. 2.9 lb. T bars, the joints between the roof sheets being welded by the oxy-acetylene process. The deck plates and moldings are all of steel.

FLOOR

The floor is supported by a 4½ in. by 2½ in. by 3/16 in. pressed angle on each side of the car, which is riveted to a 7½ in. by 3/16 in. base plate, that extends along the side of the car and is riveted to the inside face of the upper leg of the Z-bar side sill, and by four 1 13/16 in. pressed Z-bars extending the full length of the car and riveted to the 3 in. channels that extend from the center sill channel to the side sills, there being ten of these channels on each side of the car. To these supports is riveted a No. 16 gage galvanized corrugated steel plate on which is laid a 1¼ in. layer of carbolith which is held in place by chicken netting fastened to the corrugated plate. Next is a layer of 1 in. hair felt. The finished flooring is laid with 2¼ in. by ¾ in. tongue and groove maple which is nailed to nailing strips laid in the carbolith and bolted to the corrugated plate. The maple floor is underlined with waterproof paper and held ½ in. above the hair felt to provide an air space.

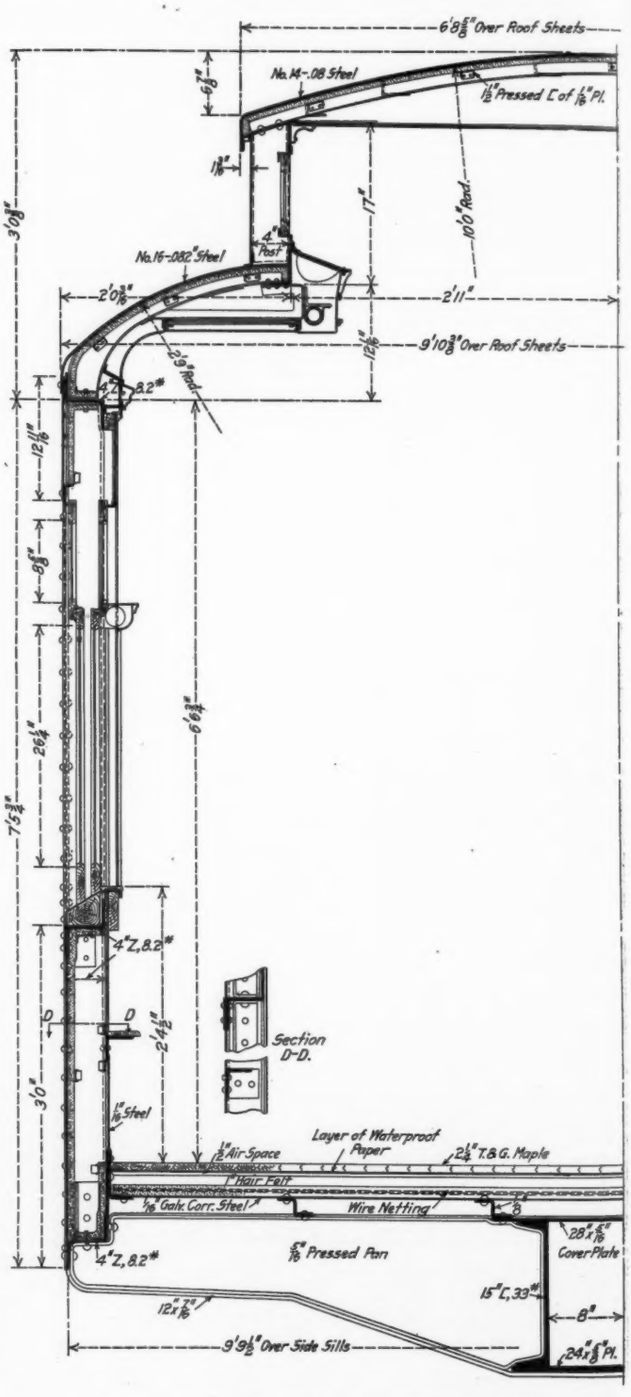
SHEATHING

The outside sheathing is ⅛ in. steel plate on the inside of which is applied a layer of three-ply Salamander. The inside sheathing is 1/16 in. steel plate and is lined with Ceilinite 3/16 in. thick. The outside sheathing is riveted directly to the side posts and the belt rail, a belt rail plate 3 in. by ⅛ in. being applied on the outside for a finish. The inside sheathing, however, has the Ceilinite extending between it and the side posts and belt rail. The letter board is a ¼ in. plate 12 11/16 in. wide, being riveted to the side sheathing and directly to the side plate with the lower deck roofing. The lower deck is roofed with No. 16 gage steel plate and the upper deck with No. 14 gage steel plate both having an inside layer of three-ply Salamander for insulation. The headlining is No. 22 gage steel sheets and is also lined with 3/16 in. Ceilinite. The Salamander is also applied to the car ends and is held in place with fireproof glue and pressed galvanized iron channels whose ends are turned against the posts and bolted. The Ceilinite on the inside of the finished plates is secured in the same manner.

OTHER DETAILS

The cars are lighted by the indirect lighting system as applied by the Central Electric Company, Chicago. The lamps and reflectors are located in the deck molding at the top of the lower deck and are so arranged as to be inconspicuous from the floor. There are 74 15-watt, 60-volt lamps used in the dining room proper and the vestibule. These are arranged in 4 ft. units containing four lamps each and 1 ft. units containing one lamp each. There are six 4 ft. unit sections placed one each side of the car and the 1 ft. units are placed between the deck beams to keep the car ceiling lighted at an equal intensity. The reflector is made of No. 20 gage steel and is covered with three coats of fired cream enamel, this color being also used on the upper ceiling. The lamps are so set in the reflector that the bases will not come within the area of the reflectors, in this way eliminating the absorption of light by the sockets. The reflectors are covered with a double layer of glass placed on an angle to minimize the collection of dust. The two layers of glass are used to prevent dust or dirt getting into the reflector. The four units are so wired that one lamp may be cut out as desired and thereby regulate the amount of light required. The total current consumption for the car is 18½ ampere hours. The average lighting intensity throughout the car on a plane 30 in. from the floor is 3.91 foot candles. That an abundance of light is provided is incidated by the interior photograph taken by the artificial illumination.

The cars are finished in a pleasing mottled gray color with gold striping on the headlining. The wood used in and about the windows is Mexican mahogany. The chairs are also of mahogany with Spanish leather covering. The dining tables are made of steel; six of them are 2 ft. 8 in. by 2 ft. 8 in. and six 2 ft. 8 in. by 4 ft. They are covered with white metal. Wall sockets are applied under the windows and just below the tables for electric table lamps. The Commonwealth Steel Company's cast steel six-wheel trucks were applied. The various specialties used



Cross Section Through the Burlington Diner

were the Miner friction draft gear class A-2-F, Sharon couplers, Woods roller side bearings, Vulcan 60,000 lb. capacity cast steel brake beams, McCord journal boxes, Christie adjustable brake heads, Westinghouse latest improved air brakes with the American slack adjuster, Railway Utility Company's ventilators, Bohn

refrigerators, and 32 Willard storage battery cells, type P. R. L. The following are the general dimensions of the cars:

Length over end sills	79 ft. 6 in.
Width over side sills	9 ft. 9¼ in.
Width over all at the eaves	9 ft. 9¾ in.
Width over clearstory	6 ft. 8¾ in.
Top of rail to top of floor	4 ft. 6 7/16 in.
Top of rail to top of buffer beam	4 ft. 2⅝ in.
Wheel base of truck	11 ft.
Journals	5 in. x 9 in.
Wheel	40¼ in. (steel tired)
Wheel centers	34 in. (steel plate)

GRAIN TIGHT CONSTRUCTION FOR SINGLE SHEATHED BOX CARS

BY W. J. TOLLERTON
General Mechanical Superintendent, Rock Island Lines, Chicago, Ill.

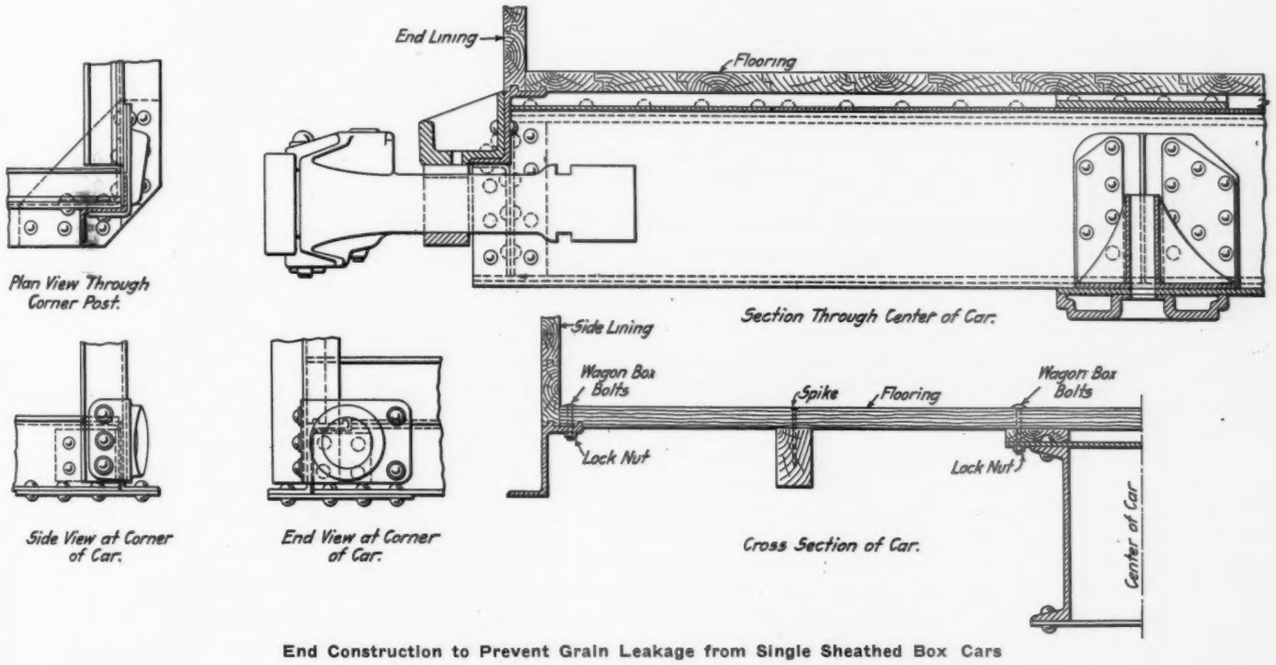
Perhaps one of the most discussed subjects appearing in the technical press today is the proper design of freight car equipment. From this fact it can readily be assumed that the mechanical men on our railroads are given much attention to the problem in order to make more efficient designs to meet the present day requirements. It is felt that cars must be kept more off the repair tracks and more in revenue service, and while in actual service they should meet all requirements. Less equipment will, therefore, naturally be required if the designs are properly made, and all phases of the treatment to which a car is subjected in service are carefully considered and arranged for. At this time, especially, the steel frame single sheathed box car is being generally considered as a design which will meet all requirements for the shipment of any commodity which can be loaded into any house car with the exception, perhaps, of a commodity requiring refrigeration.

The American Society of Mechanical Engineers, at the recent meeting in New York City, carefully considered the box car having the steel underframe as well as the steel upperframe structure, and but little was argued against the single sheathed steel upperframe car. The general opinion is that while the general construction is meeting favor, there is much yet in the detail construction which might be improved upon. The general construction of such a car naturally calls for a close study of the details entering into its design in order to get all the parts to work in harmony with each other, for a chain is only as strong as its weakest link. Cars of this design have been assigned to automobile service, and complaints have been filed relative to the double-decking of automobiles, the claim being made that the single sheathing did not furnish the proper thickness of material to which to spike the temporary framing for securing the upper tier of machines. When nails are used they pass through the sheathing and project from the outside, giving a very bad appearance, as well as destroying the sheathing. Some arrangements to overcome this have been developed and are now being tried out. Some roads are running three or four girth boards along the inside of the car, which are bolted to the side sheathing. This with the sheathing gives an ample thickness to which to nail. Other roads are using pockets secured in the side sheathing in which cross stringers are placed for the support of the upper deck of automobiles.

The lumber in the single sheathed car must be properly kiln dried, or openings between the boards will soon show up, necessitating taking the car in on the repair track and again closing them.

Much trouble was experienced along this line with the first cars of this design, but kiln drying the lumber has eliminated at least a part of this trouble. This has, however, increased the cost of the car, inasmuch as it makes extra labor and extra shop equipment necessary.

The connection between the side sheathing and the floor, in order to make a permanent grain tight joint, can surely be improved upon. When we stop to consider that the monthly claims for the loss of bulk grain due to leakage from the cars amounts to a total of as high as $10,000 on many of our larger railroads doing the grain hauling of this country, we must become convinced that some improvements should be made in car construction at this point. This loss is common to cars that have been coopered before loading. It is necessary, therefore, to add to the above the cost of coopering, which amounts to at least $1 for each time the car is loaded, as the material used for coopering is scrapped when the car is unloaded.



End Construction to Prevent Grain Leakage from Single Sheathed Box Cars

Several methods have been evolved for making a permanent tight joint at this point but none, however, have fulfilled the requirements. Hot tar pitch has been poured in the joint, but it answers the purpose for only a short time, as it soon breaks away from either the sheathing or the floor boards on account of the weaving of the car. Tin flashings have also been used, but

they are only temporary and will not stand the test of service. Many cars are built today having the floor boards gained into the side sheathing boards which, when new, makes a good joint, but it is a question if they will remain tight for grain, inasmuch as this method allows the side sheathing to bulge outward under the grain loads, thus allowing the joint to open up. In all of these methods, however, it will be necessary to destroy and entirely replace them when but few new floor boards are renewed. The scheme of gaining the lower edge of the side sheathing boards for the end of decking boards necessitates the removing of the lower part of the side sheathing in order to remove the floor boards. The gained sheathing also requires more labor and good workmanship if it is to be properly applied.

The Rock Island has just developed a design wherein an absolute grain tight joint is made between the side sheathing and the sill, as well as between the decking and the sill. It does not in any degree depend on the joint between the floor boards and the sheathing, and it cannot be affected by the racking of the car. The arrangement consists of a special Z-bar or angle for the side and end sills which has two ridges rolled in the upper flange, as shown in the illustration. One of the projections fits into the standard groove in the lower edge of the side and end sheathing, and the second fits in grooves in the ends of the floor boards, which are to be cut at the same time the boards are cut to length or squared at the end. While reference is made to a Z or angle section and the illustration shows a 6 in. Z-bar having the continuous projections on the upper flange, other standard sections can be employed, or any section could be used, with a separate steel member riveted on top of the upper flanges, which has the proper projections for engaging in the grooves in the floor and side sheathing boards.

The projection on the top flange fitting in the groove in the siding will not only give a tight grain joint, but also prevent the lower side sheathing boards from bulging out. To overcome this bulging some roads are employing a clip which is secured to the side sill by means of bolts or rivets. These clips could not, of course, be of any considerable length for they would have a tendency to collect any water running down the side of the car which would not only drain into the car but cause the sheathing to decay at this point. In the present design of steel frame single sheathed car, the side supports for the prevention of bulging of the side sheathing are the greatest distance apart at teh bottom where they should be the closest. The use of any extra posts or braces for this purpose would, of course, procure the required result, but would materially increase the weight and cost of the car. By using the standard section of Z-bar with projections as illustrated for both end and side sills, the projections on the upper flange can be run continuously around the car, making practically a sealed tight joint at both the ends, the sides and at the corners which the racking of the car will not influence. No special material is needed to make this joint tight, which eliminates any additional expense for labor or material The floor boards may be readily removed without interfering with any special arrangement or with the side sheathing.

The illustration shows that an extra good design of end sill may be obtained by the use of a 6 in. Z-section. The shape adapts itself to a good design of coupler horn striking casting, and, moreover, the lower flange of the Z-bar need not be cut away to provide the necessary coupler clearance. For the end sill, however, it is not necessary to use a Z section to obtain this grain tight joint as any sections which are rolled can be used with equally good results. No material weight is added to the car, while at the same time a gain of 5 per cent is made in the strength of both the side and end sills by the use of this grain tight construction. No extra labor is required when this section is used, over any other standard rolled section, and the steel mills will furnish the section with but slight extra cost.

As previously stated, too much attention cannot be paid to the detail construction of the steel frame single sheathed box car on account of the type coming so quickly into such general use without the slow process of evolution and service tests. While this design has been in use only about three years, the reports show that in the year 1913, 20,460, or 49 per cent. of the box cars built were of the steel upperframe single sheathed type.

CAST IRON WHEEL RECORDS*

BY H. H. VAUGHAN
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Practically all railroads have abandoned any form of cast iron wheel record which follows the history of each individual wheel. The writer believes that, apart from the records maintained for guarantee purposes, the only systems in general use are those in which the average life of wheels removed from service for various causes, is determined in various ways. It is usual to show a figure for the average life of wheels obtained by dividing the number in service by the number removed per year, but this figure is not of much value as it depends more on the rate at which the number of wheels in service increases, than in the actual life of the wheels removed. Thus if a number of wheels in service remained stationary for a period of years, while the number of wheels removed increased 25 per cent it would indicate a decrease in the average life of the wheels of 20 per cent, while if during the same period the wheels in service had increased 50 per cent, the same increase in the number of wheels removed would indicate an increase in the average life of 20 per cent.

Now if the increase in the wheels in service had taken place in two or three years, it would have had comparatively little influence on the wheels removed, and so an increase in the life of the wheel might be shown by these figures, while a reduction had actually occurred. In addition reports of wheels removed on foreign lines are not obtained correctly, especially for wheels removed on handling companies account and in general it is not uncommon for a life of twelve to eighteen years to be shown for wheels, when as a matter of fact they are lasting about five or six.

The figures showing the life of the actual wheels removed can be obtained with considerable accuracy and with simple reports and records. Each wheel is marked with its number, the date cast, etc., so that no complications are introduced by recording the date put into service and the date removed. While no record is usually kept of any time the wheel may be out of service, or the movements of the car under which it has been placed, these factors are relatively unimportant on a large number of wheels, and the average life of the wheels removed is a figure of sufficient importance on any road to justify the records and statements required. It should properly be kept by weight of wheels, so that any alteration that occurs in the life of wheels under the same weight of equipment may be distinguished from the changes due to the introduction of a greater proportion of heavier equipment or similar causes.

While the average life of wheels removed affords valuable information over a period of years, it does not enable the result of any variation in the quality or service of the wheels to be detected until considerable time has elapsed, and then only in a general way. When the wheel foundry methods of the Canadian Pacific were revised in 1908, it became desirable to introduce some system by which it could be determined whether better service results were being obtained or not, without the complications of the old individual records.

This was accomplished in a satisfactory and simple manner by comparing for each year's make of wheels, of the same weight and manufacture, the number removed for various classes of defects in each year of their life. The system does not require any additional reports over those commonly used. The

*Read before the Canadian Railway Club, Montreal, Que., January 13, 1914.

only information needed is the make of the wheel, weight, date cast, maker and cause of removal, items that are likely to be reported accurately and which are those required for a record of any kind. As the number of wheels of any group cast in each year is known, the number removed in each year's life for each cause may be expressed as a percentage of the number made and this percentage may be compared year by year to determine the comparative service obtained from the different wheels.

As the records are compiled on the Canadian Pacific, no attention is paid to the date the wheel is put into service. For wheels made in any one year, the number removed in that year is taken as being removed in the first year of their life, those removed in the next year, as in the second year of their life and so on. This introduces an inaccuracy in the case of any particular wheel placed in service towards the end of the year, but the error becomes unimportant after a year or so and the labor of compiling the record is greatly reduced.

The statement obtained by this system is shown in Fig. 1, which gives the results for 600 lb. wheels cast by the Canadian Pacific in 1902, the first year for which this statement was prepared. Similar statements have been made up for the same weight of wheel with its subsequent modification to 645 lb. and 625 lb. up to 1912, one of the advantages of this system being that with the records that had been kept it was possible without too much work to go back as many years as necessary to compare the results with those of previous years.

This statement, while giving all the information that is obtained for the wheels it refers to, does not enable any comparison to be made easily, and for that purpose a series of such statements for wheels made in successive years are combined as shown in Fig. 2. This statement shows the number of the wheels of the weight it relates to made in each year, and the percentage removed in each year of their life for all causes, except worn flange, slid flat and removed from tenders. A similar statement is made for the percentage removed each year for worn flange, and slid flat and another shows the percentage of broken wheels and broken and chipped flanges for the same series. It is evident that similar statements may easily be prepared for any cause of removal it is desired to investigate, but these are the ones that have been considered important. The elimination of wheels slid flat, worn flanges and removed from tenders, leaves a balance, that while not corresponding to the

Year	Worn Flange			Slid Flat			Broken or Chipped Flange			Broken Wheel			Total Operating Defects			Total Manufacturers Defects			Removed from Tenders			Total Number Removed		
	Number	Percent	Total Percent	Number	Percent	Total Percent	Number	Percent	Total Percent	Number	Percent	Total Percent	Number	Percent	Total Percent	Number	Percent	Total Percent	Number	Percent	Total Percent	Number	Percent	Total Percent
1902	6	0.02	0.02	149	0.49	0.49	8	0 03	0.03				163	0.54	0.54	14	0.04	0.04	118	0 39	0 39	295	0.97	0.97
1903	139	0.46	0.48	503	1.66	2.15	38	0.13	0.16				699	2.31	2.85	332	1.09	1.13	814	2.69	3.08	1845	6.09	7 06
1904	362	1.20	1.68	535	1.77	3.92	41	0.14	0.30				958	3.17	6.02	670	2.21	3.34	264	0.87	3 95	1892	6,25	13 31
1905	915	3.02	4.70	408	1.35	5.27	36	0.12	0.42				1382	4.56	10.58	780	2.58	5.92	82	0 27	4.22	2244	7.41	20.72
1906	1081	3.57	8.27	254	0.84	6.11	21	0.07	0.49				1391	4.59	15.17	816	2.70	8.62	21	0.07	4.29	2228	7.36	28.08
1907	961	3.17	11.44	231	0.76	6.87	46	0.15	0.64				1262	4.16	19.33	676	2.23	10.85	17	0.06	4.35	1955	6.45	34.53
1908	771	2.55	13.99	159	0.52	7.39	21	0.07	0.71				983	3.25	22.58	734	2.42	13.27	12	0.04	4.39	1729	5.71	40.24
1909	641	2.12	16.11	100	0.33	7.72	15	0.05	0.76				785	2.59	25.17	539	1.78	15.05	12	0.04	4.43	1336	4.41	44.65
1910	465	1.53	17.64	88	0.29	8.01	10	0 03	0 79	3	0.01	0 01	579	1.91	27.08	413	1.36	16.41	2	0.01	4.44	994	3.28	47.93
1911	223	0.74	18.38	39	0.13	8.14	7	0.02	0.81	2	0.01	0.02	289	0.95	28.03	294	0.97	17.38	1		4.44	584	1 93	49.86
1912	138	0.45	18.83	30	0.10	8.24			0.81			0.02	175	0.58	28.61	188	0.62	18.00	1		4.44	364	1.20	51.06

Fig. 1—Record of Service Given by Canadian Pacific 600 lb. 33 In. Cast Iron Wheels

Year Cast	No. of Wheels Cast	% Rem. 1st Year	% Rem. 2nd Year	% Rem. 3rd Year	% Rem. 4th Year	% Rem. 5th Year	% Rem. 6th Year	% Rem. 7th Year	% Rem. 8th Year	% Rem. 9th Year	% Rem. 10th Year	% Rem. 11th Year	% Rem. 12th Year	Lbs.
1912	15384	.06												645
1911	42105	.04	.25											"
1910	35710	.04	.27	85										"
1909	53390	.03	.38	1.11	2.28									"
1908	36165	.11	.56	1.09	1.98	3.16								600 & 645
1907	66730	.30	1.52	3.69	5.85	8.78	12.03							" "
1906	63819	.13	1.05	2.36	4.37	6.19	8.39	10.76						" "
1905	49239	.13	.83	2.40	4.53	7.10	8.98	11.01	13.50					600
1904	32852	.07	.67	1.60	2.84	4.94	7.18	8.62	9.92	10.99				"
1903	35108	.16	1.38	3.45	5.84	8.16	10.96	13.61	15.29	16.54	17.33			"
1902	30288	.07	1.29	2.64	6.33	9.09	11.47	13.96	15.79	17.19	18.19	18.81		"
1901	27749	.16	1.10	3.45	6 30	9.15	11.92	14.1	16.6	19 0	20.38	21.60	22.78	"

Fig. 2—Statement of Canadian Pacific 600 lb. and 645 lb. Wheels Removed, Except on Account of Worn Flanges, Slid Flat and From Tenders

classification of manufacturers and operating defects, is broadly affected by the quality of wheels turned out, so that the statement, Fig. 2, is a record of the foundry output in this respect.

This statement shows several interesting features. There is evidently a decided variation in the percentage of the wheels removed of different years' make, and it is only reasonable to suppose that where a larger percentage is removed in a given time, say six or seven years, the life of the wheel is less. If this be granted, some years' makes are evidently considerably superior to others, for instance those made in 1904 were far better than the average while those made since 1908 have been uniformly good.

If all wheels made were accounted for, there would of course be no assumption involved, but by an inspection of Fig. 1 it will be seen that of the wheels made in 1902, only 51 per cent have been accounted for in 1912. It is improbable that 49 per cent are still in service and the difference is therefore to be accounted for by wheels placed under foreign cars or removed on foreign roads and not reported. This discrepancy might be reduced if the number of wheels of any make placed under foreign cars were deducted from the number made before calculating the percentage, but it would introduce a complication of doubtful advantage. The chief effect of this factor is in comparing wheels received under new cars with those made or purchased for renewals. The former will evidently not be placed under foreign equipment to the same extent, but as this number has been under 10 per cent of the total number placed in service each year its effect can be allowed for.

The reliability of the statement as a whole is confirmed by the fact that since 1908 it shows a decreased percentage of

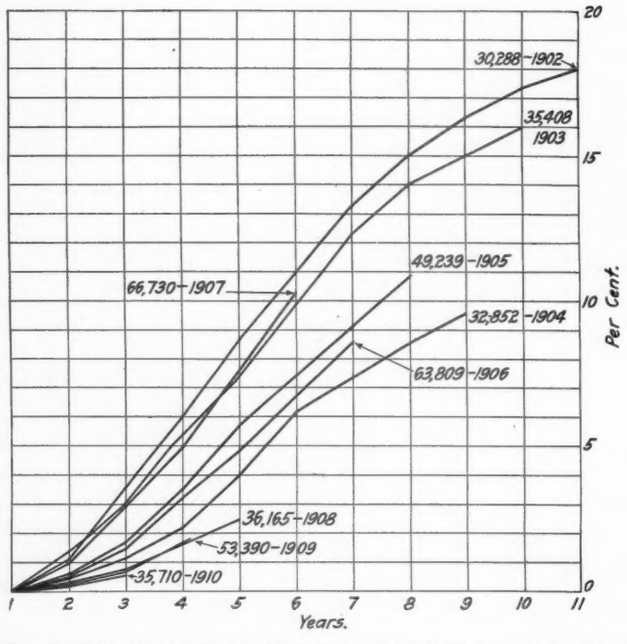


Fig. 3—Failures Caused by Manufacturer's Defects on Wheels for 60,000 lb. Capacity Cars

wheels removed and that the average life of the wheels removed has since that time increased as follows:

Year	Manufacturers' Defects	Operating Defects	Total
1908.....	5 years 2 months	4 years 5 months	4 years 8 months
1909.....	5 years 2 months	4 years 7 months	4 years 9 months
1910.....	5 years 7 months	4 years 9 months	5 years 0 months
1911.....	5 years 4 months	4 years 9 months	4 years 11 months
1912.....	5 years 9 months	5 years 0 months	5 years 4 months
1913.....	5 years 11 months	5 years 5 months	5 years 7 months

An important point in this statement is the general agreement of the results shown throughout the life of any series of wheels with those shown in the first year or two. It appears almost certain that if the wheels are of good quality and carefully inspected there will be less poor wheels to fail in the first year or so, and this result will persist throughout their life. This result is certainly true in the case of 1904 and 1908 wheels, and if it is confirmed by further experience, this form of statement furnishes a simple method of determining within a comparatively short time the service that may be expected from any group of wheels without the necessity for complicated records.

The others are also interesting statements. Wheels slid flat and with worn flanges are not chargeable against the foundry, but they may be largely affected by the shops. Careless taping and mating, cars down on side bearings and sundry other causes

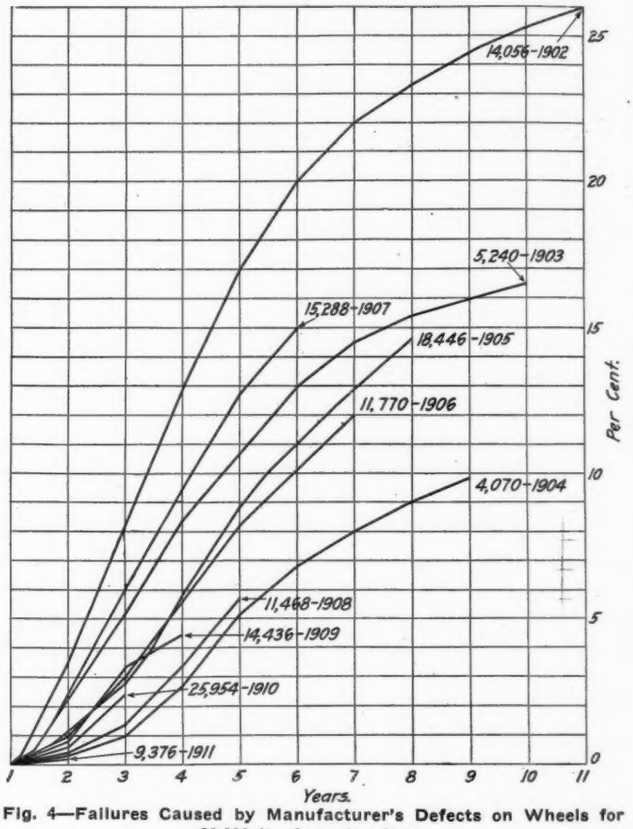


Fig. 4—Failures Caused by Manufacturer's Defects on Wheels for 80,000 lb. Capacity Cars

for worn flanges are all avoidable and results may be followed by means of this report. Slid flat wheels are also caused by improper maintenance and operation, and may be largely reduced by care.

The statement shows that there is comparatively little difference between the wheels removed of the various years' make for being slid flat. There is, however, a most decided difference in the number removed for worn flange, the wheels made in 1906 being considerably better than those of previous years, while there is a still greater reduction in 1908. The percentage of 1908 wheels removed in five years from this cause is only about 40 per cent of the number removed in an equal time of the 1909 wheels and less than 20 per cent of the corresponding number for the wheels made in 1903, 1904 and 1905. In 1908 the method of taping was carefully gone into and the work carried on with greater care so it would appear that the proper carrying out of this work is most important to avoid injury to wheels from worn flanges. To the end of the fourth year the 1909 wheels are even better, so that the 1908 results were not simply accidental, but the consequence of greater care and better methods.

Before leaving this description of these records it is interesting to note that they may be easily plotted. Figs. 3, 4 and 5 show the percentage of wheels of 600 lb., 650 lb. and 700 lb.

weight respectively removed for causes other than worn flange, slid flat, and removed from tenders. These diagrams illustrate the statement that a group of wheels that show up well in the first two years will show correspondingly good results throughout later years. They are also interesting as showing the great difference between various groups of wheels and the improvement that took place in 1908 and subsequent years.

Reference has been made throughout this paper to the revision of the Canadian Pacific foundry methods in 1908 and to the results obtained since that date, which evidently show a considerable improvement. Prior to that date the mixture had been handled by brands and numbers, and as the records show in some years very good wheels were made and in others the results were not so good.

In the years 1906 and 1907, considerable trouble arose, a large number of failures occurring in service caused, as was subsequently discovered, chiefly by iron of widely varying silicon content, but of the same brand, being used indiscriminately. The system of inspection was not sufficiently thorough to reject all wheels of improper quality, and while the records in use at that time did not indicate anything unusual, sufficient trouble

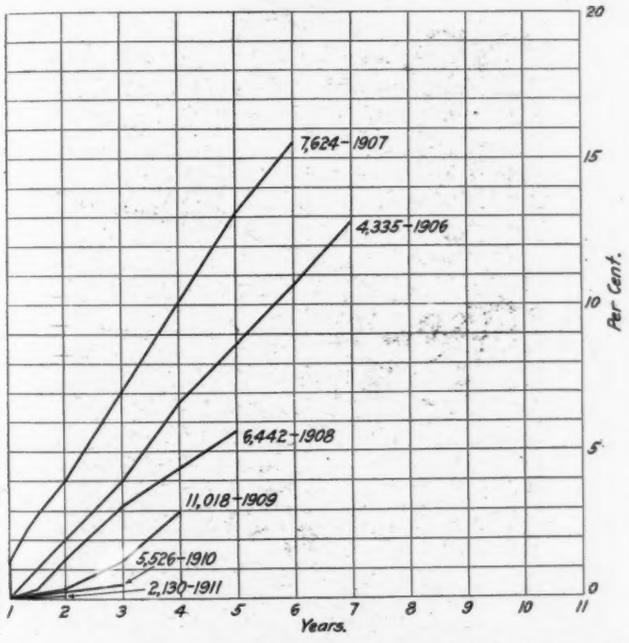


Fig. 5—Failures Caused by Manufacturer's Defects on Wheels for 100,000 lb. Capacity Cars

developed in service to draw attention to the irregularity in the wheels.

Ira B. Lesh was engaged to organize the manufacture on a basis in which the mixtures would be accurately determined by chemical analysis and the inspection effective to reject any of the product that was not of the proper quality. A proper mixture is of course only one of the factors entering into the manufacture of a satisfactory wheel and considerable attention was paid to other points as well, with the results that obvious defects disappeared while the records show that a permanent improvement was obtained.

It is not the intention to make this paper one on the manufacture of chilled cast iron wheels, but in view of the enormous importance of the subject, it is interesting to describe the lines on which the Canadian Pacific practice has been developed and discuss the opportunities for improvement.

The writer considers one of the most important factors in obtaining good wheels is that of inspection. Absolutely uniform and perfect foundry practice is of course the great thing to obtain and the most difficult, but that is a portion of the subject which would be better described by some competent wheel manufacturer. Inspection should detect those wheels which for any reason depart from the accepted quality, and for this purpose the wheels to be tested should be selected with care and sufficient wheels broken from any days run to insure the rejection of any that are either too hard or too soft.

This may be accomplished by comparing the tapes and chill tests and rejecting all soft and hard wheels until it can be determined within reasonable limits that the wheels accepted are good.

Inspection should, of course, detect all ordinary defects, but it can be carried on to properly protect the heat, and this is most important. One thing should be remembered, that out of the ordinary lot of wheels, 60 per cent will run through their life and be removed without any defect that reduces the life of the wheel so that it looks very much as though the question of getting the other 40 per cent out of the way by better practice or improved inspection were the important ones.

The question of mixtures is a very vexed one. Prior to 1908 charcoal iron was extensively used on Canadian Pacific and the trouble that occurred was caused by its improper use and not on account of its quality. Since that time its use was abandoned for about two years and it has subsequently employed to the extent of 10 or 15 per cent of the mixture. In spite of the great reputation of charcoal iron, it is a question to what extent it can be better than coke iron after being melted in a cupola heated by coke. This statement is not intended to refer to the use of iron with a low sulphur content to prevent the constant increment in sulphur which occurs from remelting with coke, but refers to the value of charcoal iron as against coke irons. Good results have certainly been obtained from the latter if properly handled, but on the other hand if any advantage in strength can be shown for charcoal iron the additional cost is not worth considering. The great question at the present time is that of improving the quality of the chilled wheel. It has only one serious point of weakness, the danger of broken flanges. The records show that the number of broken flanges has been greatly reduced since 1908. If this is correct, the causes are the reinforced flange, careful manufacture, good inspection and a rather hard wheel.

The reinforced flange was introduced in 1906-7 when the 600-lb. wheel was changed to 645 lb., and it would appear that this change made a great improvement.

The Canadian Pacific practice has, during the past few years, run to a hard wheel, the rule being to use the M. C. B. limits for depth of chill, applying them to the pure white iron only. This was introduced on account of an investigation made on a number of wheels causing derailments on account of broken flanges, which showed that the majority were soft wheels, having ⅜ in. or less depth of chill. It would certainly appear that a light chill is a cause of weakness not only in the tread under heavy loads, but in the flanges. This may be explained by the structure being that of a hard rigid surface joined to a softer and less rigid back. Grey iron, while often considered as a rigid material, has only about 50 per cent to 60 per cent of the rigidity of the white iron, which probably corresponds closely to that of hardened steel. When this compound structure is subjected to any force, placing a tensile strain on the surface, this strain is largely localized on the layer of white iron, the grey iron beneath it taking less than its share on account of its greater elasticity. It is therefore necessary to maintain a sufficient depth of white iron to resist a force of this nature, which is that brought on the flange by the rail, and it is evident that the white iron is greatly assisted when backed up by a large amount of grey iron, which is the case when the flange is reinforced as in the later designs of wheels. This is probably the correct explanation of the greater amount of flange breakage with soft wheels, and it is apparently confirmed by the results that have been obtained.

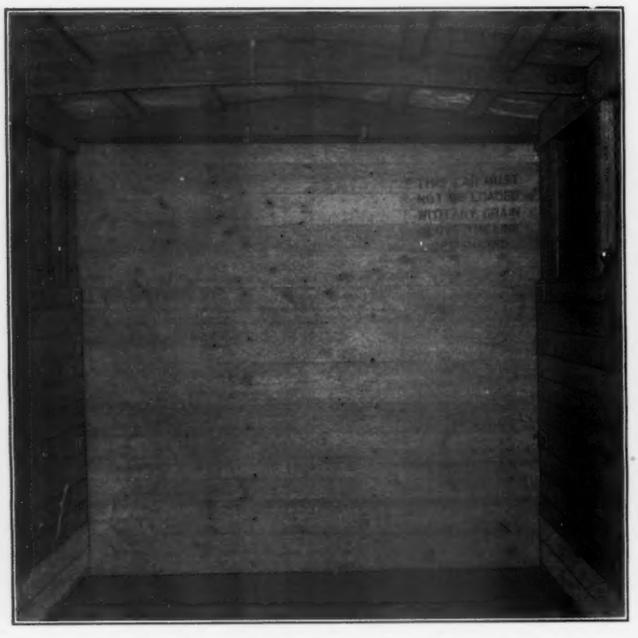
There is good ground for expecting that the use of the re-

inforced flange and better knowledge of the causes governing the strength of white iron may lead to considerably better results being obtained from the chilled wheel in the future.

On light equipment with less severe brake service than is usual today, the chilled wheel has given excellent results and is even now most economical and satisfactory in most respects. Flanges practically never break through the line in which they are restricted in strength, and until they do so, there is every reason to hope that the cast wheel may be able to hold its own, and in time to render the good service it has in the past.

REINFORCING WOODEN BOX CARS ON THE CANADIAN PACIFIC

While a great deal of attention must, of necessity, be given by the railways to providing high capacity in new freight equipment in order to meet severe modern conditions, there are thousands of wooden cars which, with a comparatively small expenditure, can be so strengthened as to make them quite serviceable, even in heavy traffic, for many years to come. A great deal has been accomplished along these lines, some roads



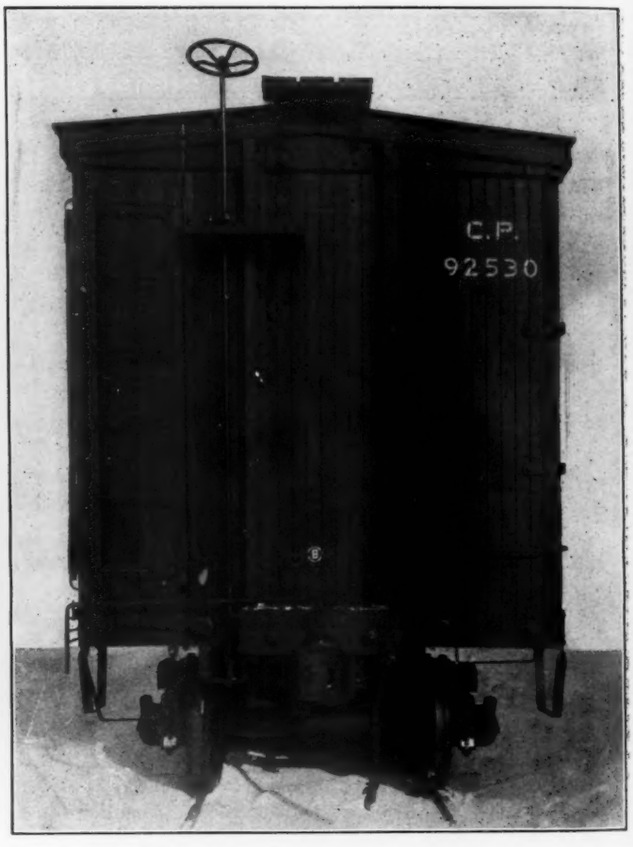
Beside Strengthening the End of the Car the New Lining Forms Grain Tight Joints

even going so far as to apply an entire steel underframe to cars which previously were equipped with a wooden underframe.

In the reinforcing of wooden box cars on the Canadian Pacific to meet the heavier traffic requirements, methods have been adopted which, while providing ample strength, require a minimum of material and expense. In strengthening the ends of the cars, even if the lining is damaged no attention is given to it. The old lining is left in place, and the time which would be used in ripping it out is saved. The end is relined with 1½ in. or 1¾ in. decking, placed directly over the old lining, the length stenciled on the car being corrected accordingly. This new lining not only greatly reinforces the end of the car, but also is easily made grain tight at all the joints, making it unnecessary to depend on the outside sheathing to hold grain. On the outside of the car, two 3 in. 6.7 lb. Z bars are bolted to the old posts (cracked posts not being removed), and also bolted through the end sill, the end lining and the end plate. The bolts are staggered so that one bolt passes through each board of the new end lining. The new end lining is thus made to assist to a great extent in supporting the end sill and in turn the ends of the center sills.

In reinforcing the underframe the wooden center sills are removed, but the intermediate and side sills are left in place. The two wooden center sills are replaced by two 6 in. 22.7 lb. Z bars which extend the entire length of the car. The Z bar center sills are attached rigidly to the end sill and also riveted to the body bolster. It has been found that the Z bar center sills, reinforced by their attachment to the bolster and end sill, are sufficiently rigid to transmit all draft and buffing shocks to the bolster, and the latter distributes the shocks evenly over the entire underframe between the bolsters. Whatever flexibility is required is amply provided by the new center sills between the bolsters, and the strengthening of the end is ample to support the end sill and in turn the outer ends of the center sills and their draft gear connections.

Cars which have been strengthened in this way are giving every satisfaction in service. A large number of cars are having these reinforcements added to them at the Angus shops in Montreal, and the new steel sills are also made ready at that point, complete with the draft gear, and are shipped to outlying points for application to cars. To date 8,900 cars have been built new with these steel sills, and 2,600 old cars have been reinforced.



The Ends of Wooden Box Cars Are Reinforced with Z-Bar Posts Bolted Through the New Inside Lining

Very few of these steel sills have been sent to the shops for repairs, and the indications are that the amount of repairs necessary would be as great even with the use of the later and more expensive designs of steel underframes.

Gas in Railway Carriages.—We understand that measures are in progress for the introduction of portable gas for the lighting of railway carriages. One carriage has been already furnished with this illuminating principle.—(*Manchester Advertiser.*)—*From the American Railroad Journal, April* 5, 1834.

SHOP PRACTICE

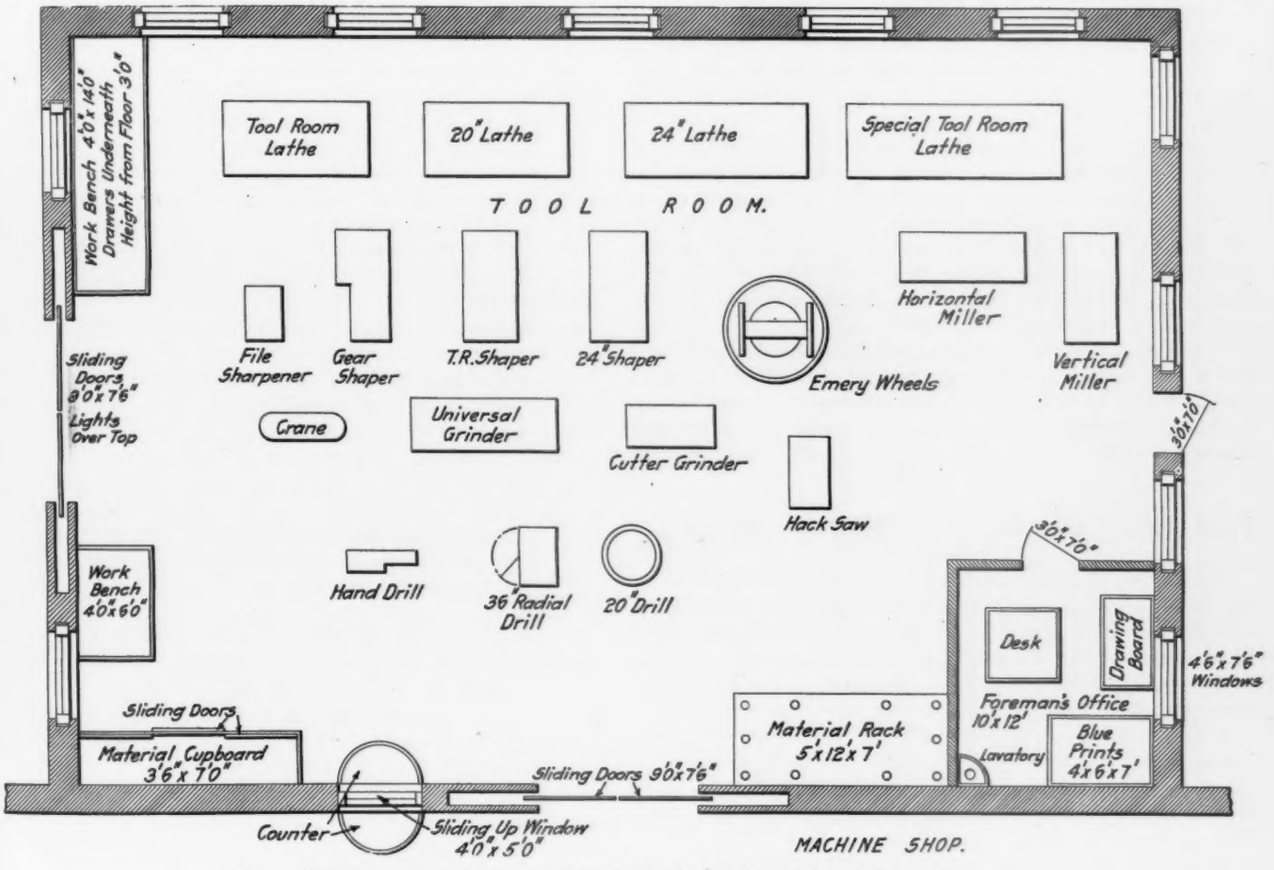
TOOL ROOM EQUIPMENT AND MANAGEMENT

BY PAUL R. DUFFEY

The tool room of a locomotive repair shop is one of the most important, but oftentimes one of the poorest equipped and most neglected departments in the whole shop. In many instances it is located in an out of the way corner, causing the workmen who are in need of tools to waste much time in going back and forth.

In properly planning a tool room it is necessary to consider the distribution and care of small tools, the repair of intricate machine parts, special tools, jigs, air motors, pneumatic hammers, manufacture of new dies, etc. Care should be exercised in regard to the location, in order that all the shops may be conveniently served. Large repair shops have as a rule a main tool room and one or more sub-tool rooms, which relieve the main room. The sub-tool rooms may be located, for instance, one centrally in the machine shop, which serves the machine and erecting shop, and if there is a large boiler shop there should be a suitable room provided to serve it individually. The equipment of small and special tools should be governed in each sub-room by the average monthly engine output. The arranging of the room and tool racks should receive particular attention with respect to accessibility. All shelves, pigeon holes and bins should be plainly stenciled, and a sufficient number provided to accommodate all the tools. A large metal covered counter, protected by a high wire grating, should extend around the entire service portion of the room, and suitable openings should be provided in the grating to facilitate the distribution of the various tools to the workmen.

In most cases it is well to employ an experienced grinder to look after the grinding of such tools as twist drills, reamers, cutters, etc. Thus it is obviously necessary to have suitable machines installed for carrying on this work. Such an arrangement increases the efficiency of the tool room. The stock of tools kept in the sub-tool rooms should be under the general supervision of the tool room foreman and under the direct supervision of the sub-tool room assistant, who should not only be a good practical man but one who will take a keen interest in his work and strive to work for the company's interest at all times.



Suggested Arrangement of a Tool Room for a Locomotive Repair Shop

Having discussed one function of the tool room we turn to the repairing of machinery parts, manufacturing of new parts, jigs, dies, taps, reamers, etc. This work is as a rule of such quantity and quality as to require a specially equipped shop or room; the ideal place for such a room is away from the noise of the erecting shop. It could be built adjoining the machine shop, and centrally located with reference to other shops. This avoids the necessity of workmen other than those employed in the tool room entering in search of tools and the consequent misplacing of unfinished work. As tool making, die sinking, etc., is work of a high quality, care should be used in constructing a roomy shop, well lighted

and aired, as well as having it suitably equipped with modern machine tools.

The machine arrangement in the tool room of a large repair shop should be studied to meet the most efficient methods of handling the work. As a suggestion of the desired equipment, the following tools may be mentioned. The illustration shows the floor arrangement of the tools:

1 12 in. power saw.
1 power filing machine.
1 tool grinder, 2 wheels, 12 in. and 16 in. diameter.
1 universal cutter grinder.
1 universal tool room grinder.
1 24 in. engine lathe, 7 ft. bed.
1 20 in. engine lathe, 10 ft. bed.
2 14 in. or 16 in. tool room lathes with all special attachments.
1 gear shaper equipped to cut bevel and spiral gears.
1 universal horizontal milling machine.
1 vertical miller with slotting attachment.
1 36 in. radial drill.
1 20 in. power drill.
1 hand fed sensitive drill.
1 24 in. crank shaper.
1 16 in. crank shaper.
1 pneumatic press.
1 portable center grinder (electric drive).
1 portable electric crane (self propelled), 3 tons capacity.
Electric hardening and tempering furnaces.

The tool room should also be provided with a complete set of standard snap, plug and ring gages, micrometers, straight edges and other tools which few individual tool makers carry.

Managing a tool room is a task which requires an efficient foreman. The tool room foreman should be given entire charge of all the sub-tool rooms as well as the main room, and all material requisitions should bear his signature before the material is ordered. In too many instances this matter is slighted and tools of low grade furnished because the persons who ordered the tools were unfamiliar with the requirements. The foreman should be a good practical man, who can read drawings, design and sketch machine parts and has a thorough knowledge of the work for which the tools will be used. In order that he may efficiently operate his department a suitable office, containing desk, blue print and record case, and drawing table, should be provided for his use.

PROTECTION OF GRINDING WHEELS

The Norton Company of Worcester, Mass., through its research laboratories recently conducted a series of tests on the relative protection offered to the operator of a grinding wheel by an improved type of protection hood and of beveled flanges.

The testing equipment consists of a modern grinding wheel stand, the wheel being driven by a belt from a gasolene engine. For the protection of the investigator, a wooden framework of heavy timbers was built over the side of the stand on which the wheels were to be tested. In all tests the wheels were operated at 6,000 peripheral feet per minute and the speed was very carefully regulated.

In the hood tests the wheels used were 16 in. by 2 in. by 1¾ in., alundum, vitrified and of various grains and grades. These wheels had parallel sides. The hood was of modern type and the wheels were mounted between relieved cast iron flanges 8 in. in diameter. One layer of blotting paper of standard thickness was used between the wheel and each flange. The nut on the spindle was not tightened excessively, but drawn up enough to hold the wheel firmly. The wheels in these tests were broken by dropping a steel wedge between the rest and the side of the wheel in such a manner as to give a severe blow. The object was to duplicate as nearly as possible one of the most frequent causes of accident, namely, that of work being caught between the rest and the wheel.

In the flange test the wheels used were all 24 in. by 2½ in. by 1¾ in. alundum, vitrified, grain 14, grade O, tapered both sides ¾ in. to the foot, with a flat at the center of 4 in. in diameter. One section of standard blotting paper was used between the wheel and each flange. In these tests five sets of relieved steel flanges tapering ¾ in. per foot were used, the diameters being 12 in., 14 in., 16 in., 18 in., and 20 in., respectively.

The wheels in the flange tests were broken by swinging a 130 lb. cast iron weight against the side of the wheel. This method of breakage corresponds to a common cause of accident when heavy castings, which are suspended by tackle over the wheel, are carelessly allowed to strike the side of the wheel with enough force to cause breakage.

In none of the tests with the hoods did a piece of the wheel leave the hood in a way that could have caused damage. The tests showed conclusively that a well designed protective hood, made of the right material and properly adjusted, affords ample protection for straight side wheels, even when they are mounted between standard, straight relief flanges having a diameter equal to one-half the diameter of the wheels.

It was not the intention of the tests to obtain data from which standard specifications for hoods and flanges could be drawn; nevertheless, the tests, as a whole, brought out a number of points that could be so used. The specifications for hoods for rough grinding should not only require a certain strength, as determined by the design and material used, but they should also require that the top end of the hood have some sliding-tongue device which can be adjusted as the grinding wheel wears, and thus offer at all times the maximum protection possible. They should also contain a definite statement as to the maximum exposed grinding surface allowable for the common variety of grinding. They should further state the minimum size wheel allowed in a hood of given dimensions.

The conclusions on the tests show that protection hoods offer greater safety than do safety flanges. The protection offered by any given taper with a safety flange decreases with the decreased diameter of the wheel. To provide equal safety on all sizes of wheels would require, therefore, a graduated difference in taper. A hood with an adjustable top furnishes equal protection for a wide range in the diameter of wheels.

Second to safety, the cost of operating a given grinding machine is of vital interest. In this respect adjustable hoods have the better of the argument for, as the wheel wears, protection flanges must be changed frequently. Such change involves the removal and remounting of flanges and wheels, whereas, in the case of a hood, the change would merely involve a set screw adjustment.

To provide adequate protection for wheels 3 in. and thicker, the thickness (hence the weight) of flanges would have to be increased beyond that of any flange now on the market. This would mean added momentum to the revolving spindle which, in turn, would require greater rigidity and strength than is found in the majority of present day grinding machines.

Since the face of the tapered wheel becomes wider as the diameter decreases, serious inconvenience is caused in all grinding where the wheel must work in a slot. Tapered wheels do not permit grinding of right angle shoulders as do straight wheels. Laws in almost every country require the removal of dust from grinding. This requires the use of a hood, and if a hood must be used, it might just as well be strong enough to offer protection in case of an accident. A proper hood offers complete protection. Protection flanges do not offer this complete protection, but in instances where a hood would interfere with the proper use of the wheel, flanges offer the next best method.

BRIQUETTES IN EUROPE.—While in France, with brittle coal there are 12,000,000 tons of briquettes made yearly, and in Germany, with soft brown coal, there are 16,000,000 tons made, in Great Britain but 2,000,000 tons are produced, and these mainly in South Wales, where the dry coal briquettes more easily than the greasy English coal which needs a strong binder.—*The Engineer.*

SPECIAL TOOLS IN THE MACHINE SHOP

Include a Three Tool Boring Head, a Bolt Chuck, and a Jig for Use in Boring of Side Rods

BY WALTER B. LYONS

THREE-TOOL BORING HEAD

A soft steel three-tool head for the boring bar of a horizontal boring mill is shown in Figs. 1 and 2. The tool slots

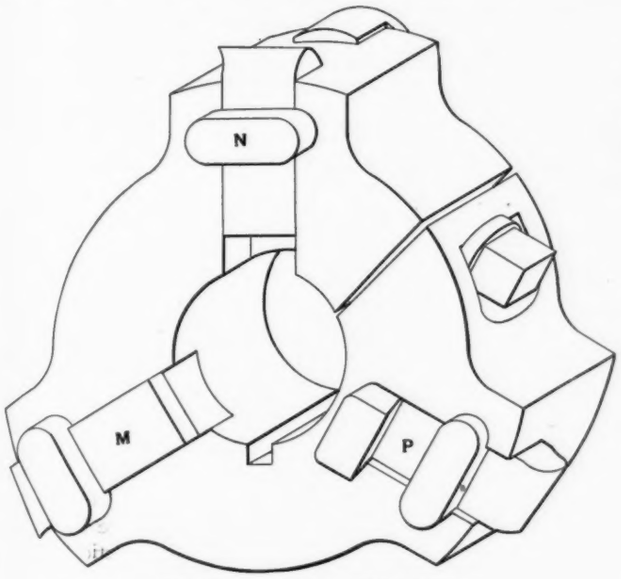


Fig. 1—Three Tool Boring Head

are made ⅛ in. different in depth, i. e., ⅝ in., ¾ in. and ⅞ in. deep, which gives each preceding tool ⅛ in. lead over the following tool. The middle slot *N* is slotted on both sides of the head, with the slot for the tool clamp extending entirely through the head. This is done so that the tool may be removed and inserted in the opposite side for facing off the back end of the work. The block back of the tool *P* is tapered so that by screwing up the nut on the end the tool may be adjusted to the exact position, and then held rigidly in position by the tool clamp. This wedge also prevents the tool from slipping back if it chances to become a little dull in passing through the bore. It also permits a quick adjustment of the tool, which may be done as the cut is starting. The body of this head is made in several different sizes, but the tool clamp, wedge and key are all made to fit in any of the heads.

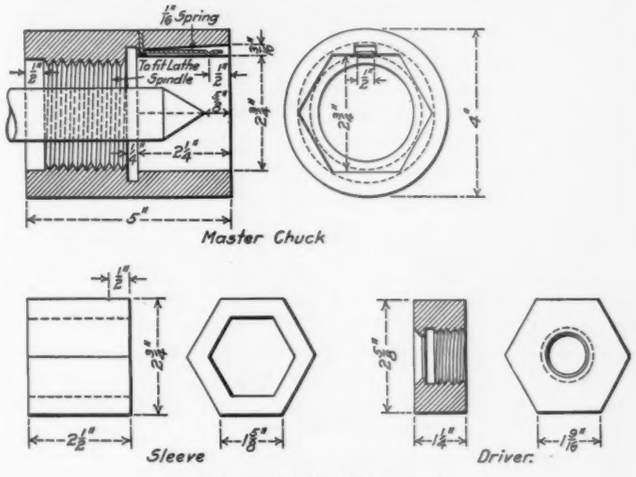


Fig. 3—A Safe Bolt Chuck

BOLT CHUCK

The bolt chuck shown in Fig. 3 is constructed largely with an idea of safety; that is, to eliminate as far as possible all danger of the operator being caught in the machinery. The body of the chuck is made to fit the spindle of the lathe, while the opposite end is made hexagonal in shape and ⅛ in. larger

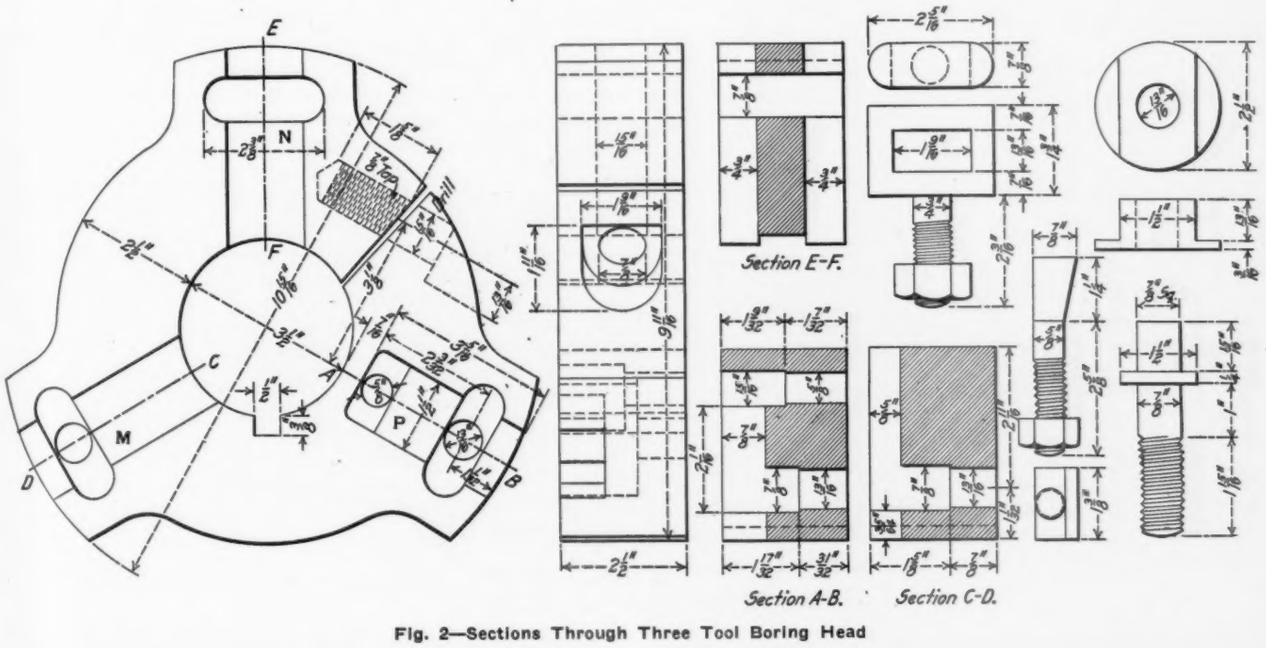


Fig. 2—Sections Through Three Tool Boring Head

than the head of the largest bolt to be turned. The head of the bolt is held in a sleeve that fits in the chuck. These sleeves are made to accommodate the different sizes of bolts and when the bolts are made on bolt machines the heads will be uniform, so there will be no trouble in fitting them in the sleeves. The threaded sleeve is used when it is desired to turn a bolt with a countersunk head. The sleeves are made ⅛ in. larger than the head of the bolt, and the hexagon threaded driver ⅛ in. smaller than the hexagon of the master chuck to allow the lathe to be set for taper bolts. The spring shown in the master chuck is used to keep the sleeves from shaking out. This chuck does away with all need of a face plate or dogs, and being round and without projections makes it almost impossible for an operator to be caught while filing the bolt.

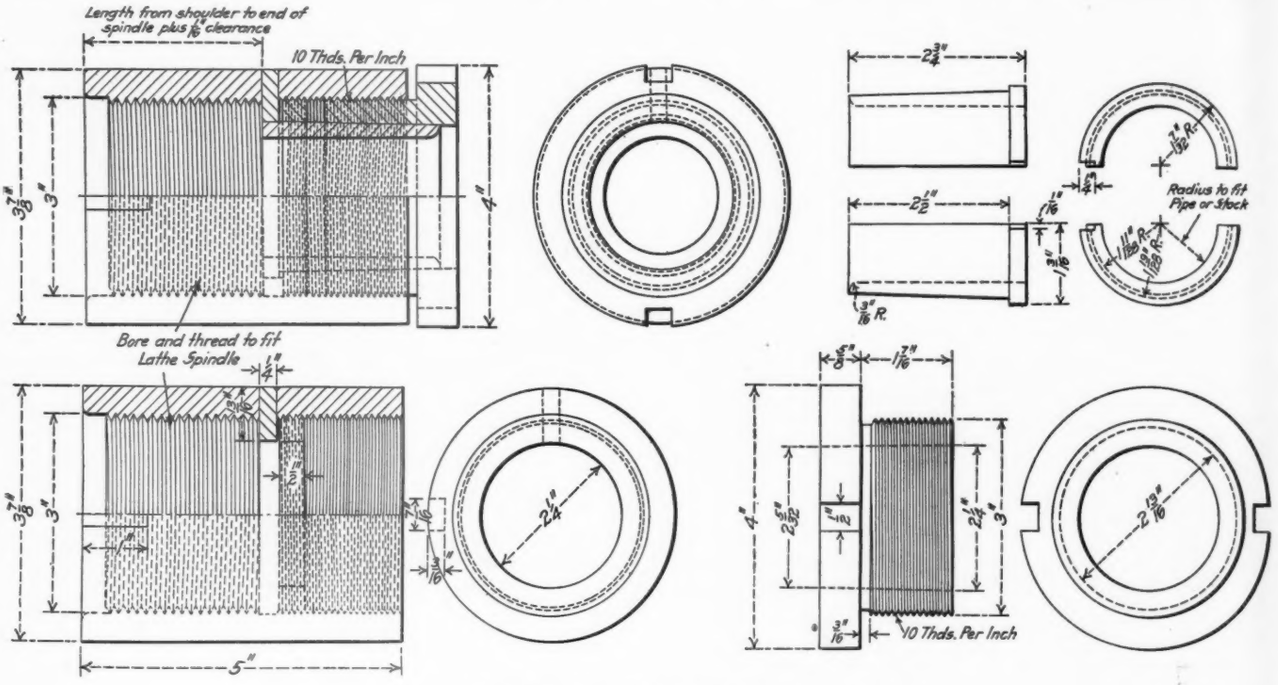

Length from shoulder to end of spindle plus 1/16 clearance
10 Thds. Per Inch
Bore and thread to fit Lathe Spindle
Radius to fit Pipe or Stock
10 Thds. Per Inch

Fig. 4—Lathe Chuck for Holding Pipe or Round Iron

LATHE CHUCK FOR SMALL WORK

A chuck designed for holding round iron or small pipe in a lathe is shown in Fig. 4. The body of the chuck is round, similar to the bolt chuck shown in Fig. 3. The inside is threaded to receive the sleeve, which is provided with a collar having two ½-in. notches for a spanner wrench. The inside of this sleeve is bored with a taper and holds two split sleeves which are bored on the inside to fit the radius of the stock to be turned and on the outside to fit the taper of the threaded sleeve. When the threaded sleeve is screwed into the body it forces the split sleeves farther on the work, and the farther the sleeve is screwed in, the firmer will the work be gripped. The split sleeves are also provided with collars which fit over a retaining ring that is screwed into the body of the chuck against a ¼-in. dowel pin. This dowel fits in between the split sleeves and prevents them from turning when the threaded sleeve is being screwed in or out.

BORING BAR HEAD

The single boring bar head shown in Fig. 5 is designed for light work, such as truing up air pump cylinders, and similar work where only light cuts are to be taken. The head is fastened to the bar by means of a tapered split sleeve made of annealed tool steel, which is inserted in the head from the back end.

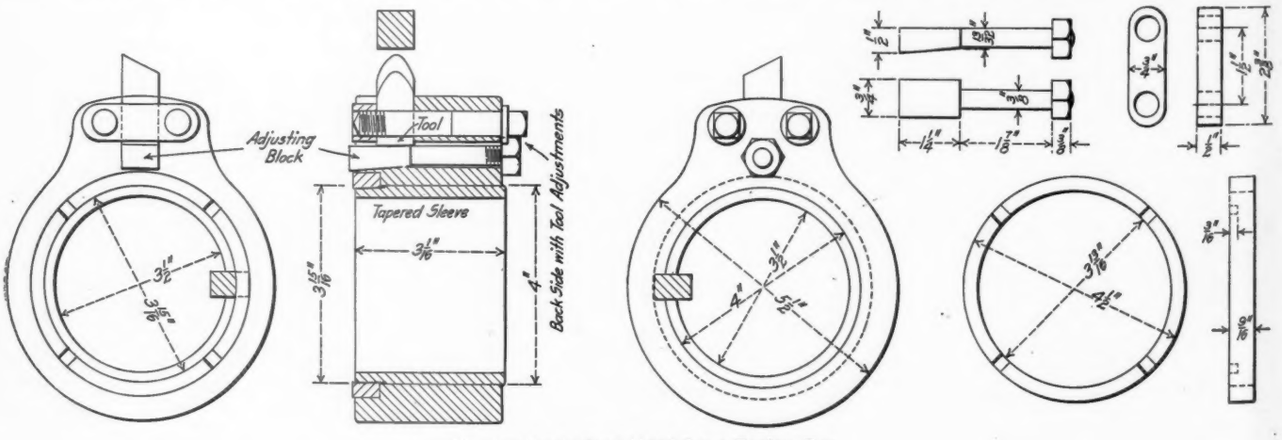


Fig. 5—Single Tool Head for a Boring Bar

The head is bored ½ in. larger than the bar and with a 1/16 in. taper from the back end. The sleeve is threaded on one end with 14 threads per inch, and is screwed in a ring which

has a working fit in the counter bore in the tool head body, the sleeve being made with a taper on the outside to fit the taper in the body. By screwing up on this ring by means of a spanner wrench, the sleeve is drawn into the head gripping the boring bar as tightly as desired, the split in the sleeve being large enough to pass the key used for driving the head. The

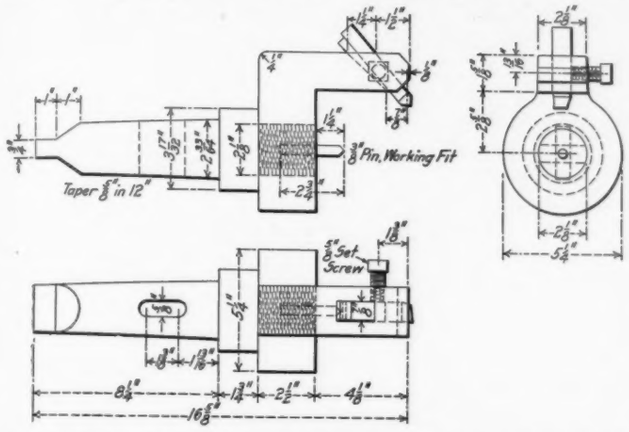


Fig. 6—Boring Mill Tool for Turning Surfaces Which Cannot Be Handled in a Lathe

tool is held in the head by a clamp having two bolts inserted from the back and screwed into the clamp across the front of the head. This clamp is fitted in a recess in order to have as few projections as possible. A bolt with a wedge-shaped head is inserted under the tool and is used to adjust it as well as to prevent it from slipping back, thus making it unnecessary to put

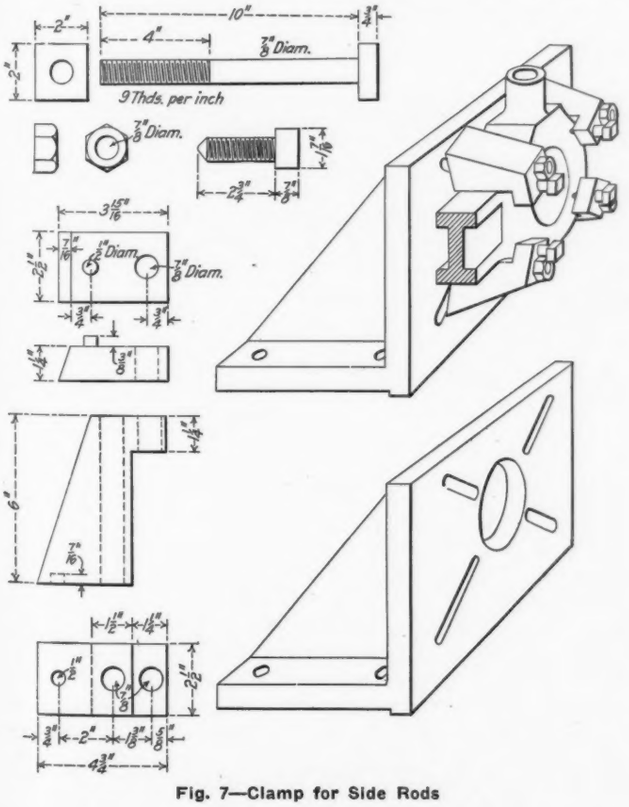


Fig. 7—Clamp for Side Rods

an excessive strain on the two clamp bolts in order to hold the tool.

TOOL FOR TURNING OUTSIDE SURFACES ON A BORING MILL

The tool shown in Fig. 6 was designed for use on horizontal boring mills for turning the grease cups on driving rods, turning the ends of rocker arms and truing the end bearings of tumbling shafts. It is made in two pieces, as it was found that it could thus be made easier and cheaper. The shank is threaded and screwed into the head and in case the shank should become bent in the neck it is easily replaced, making the tool as good as new. The ⅜-in. pin in the center of the shank is used for centering the work, after which it is removed so as to allow the tool to cut as far as possible. When truing up the ends of tumbling shafts, place the shaft in V-blocks on the table and center it with the ⅜-in. pin in the tool and a dead center placed in the boring bar support. After it is firmly clamped remove the center pin from the jig and proceed to true up the bearings. The tool in this jig is placed at about 15 deg., so that the point will be in advance of the end of the jig.

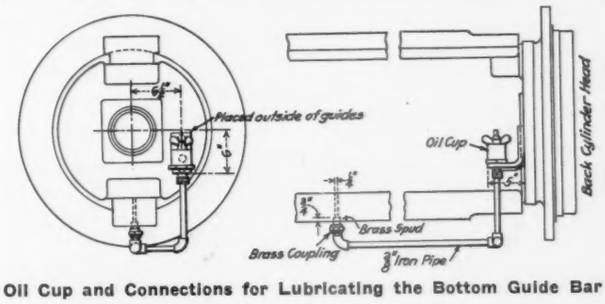
JIG FOR BORING SIDE RODS

The jig shown in Fig. 7 is used for clamping side rods to a boring machine. It is made from a solid angle plate and has four clamps as shown in the illustration. The bolt hole in the clamp is placed close to the inner edge so as to give the clamp as much heel as possible. The thin blocks shown are used under the clamps when it is necessary to raise them to accommodate the different thicknesses of rods. This method is used so as to bring the lip of the clamp as close as possible to the rod, making it possible to use a short set screw, which will provide a more substantial clamp than where a long set screw is used. With this jig a rod can be quickly removed and another placed in position by simply removing the two top clamps. The angle plate is provided with slots in place of holes to accommodate the different sizes of rods, and by this means the clamps are brought as close as possible to the rods.

LUBRICATING BOTTOM GUIDE BARS

BY ALDEN B. LAWSON

There has always been difficulty experienced in lubricating the lower guide on locomotives when the two bar type is used. The oil is generally fed at the end of the guide, and the crosshead very frequently pushes it off. To overcome this and get the oil to the center of the guide the arrangement shown in the illustration has been placed in service on some Baltimore & Ohio locomotives and is giving excellent service. The oil cup is supported by a wrought iron bracket fastened to the back cylinder



Oil Cup and Connections for Lubricating the Bottom Guide Bar

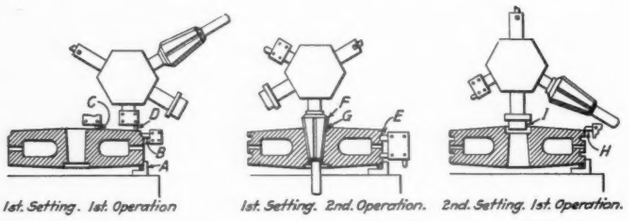
head and a pipe connects the cup to the under side of the lower guide, the guide bar being drilled. The cup is some distance above the bearing surface of the guide, which permits the oil to feed through the pipe and force itself up to the face. The cup used should be one on which the feed may be regulated.

LARGEST ELECTRIC HOIST IN AMERICA.—One of the largest electric hoists in the world, and exceeded only by a few in South Africa, will be installed in the Granite Mountain shaft of the North Butte Mining Company. The hoist will have a capacity of 300 tons per hour hoisted from a 2,000 ft. level, or 200 tons per hour from a 4,000 ft. level.—*Scientific American.*

MACHINING PISTONS ON A VERTICAL TURRET LATHE

BY C. M. NEWMAN
General Foreman, Atlantic Coast Line, South Rocky Mount, N. C.

The accompanying table and illustrations show the method employed in the machining of 22 in. solid pistons on a 36 in. Bullard vertical turret lathe at the Atlantic Coast Line shops, South Rocky Mount, N. C. Sketches showing the special tools used in performing the operations are also included. By referring to the table it will be noted that the operations

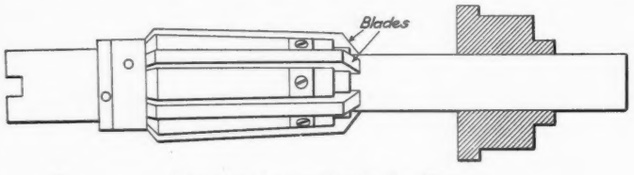


are grouped so that the shorter ones can be performed while the longer ones are in process. By this arrangement the time necessary to perform eight separate machine operations is reduced to that necessary to perform the three longest operations. In addition to the time saved by arranging and grouping the operations, the special tools have been so constructed that they are capable of performing a combination of operations as one; for instance, the reamer makes the piston rod fit from the rough, removing the necessary stock and at the same time reaming the taper and finishing the hole. The body of the reamer is made of a good grade of machine steel while the blades are high speed steel, inserted, and are arranged for

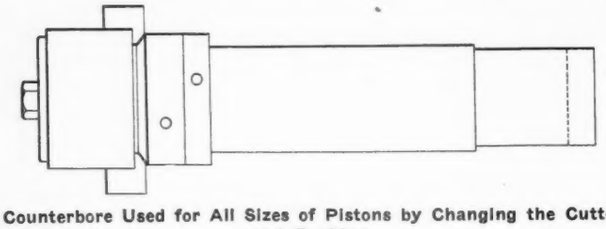
OPERATIONS AND TIME REQUIRED FOR MACHINING A 22 IN. PISTON ON A 36 IN. BULLARD VERTICAL TURRET LATHE.

	Item.	Surface Machined.	Operations.		Depth of cut.	Feed per rev.	Rev. per minute.	Minutes, each operation.	Actual minutes required.
Setting No. 1	1	A	Chuck work					5	5
	2	B	One tool, 5½ in. length of cut	Simultaneous cuts	5/16 in	1/16 in.	6	15	15
	3	C	One tool, 1½ in. length of cut		⅛ in.	1/12 in.	6	3	
	4	D	One tool, 1 in. length of cut		⅛ in.	1/12 in.	6	2	
	5	E	Gang tool, ¾ in. x ¾ in.	Simultaneous cuts	7/8 in.	1/90 in.	6	13⅛	13⅛
	6	F	One reamer, 6 in. length of cut		½ in.	1/12 in.	6	12	
	7	G	One tool, ¼ in. fillet		¼ in.	1/12 in.	6	½	
	8	..	Turn piston over					2	2
Setting No. 2	9	..	Chuck work					5	5
	10	H	One tool, 1 in. length of cut	Simultaneous cuts	5/16 in.	1/16 in.	6	2⅝	2⅝
	11	I	Counter bore, ½ in. x 1 in. x 5 in.		⅜ in.	1/16 in.	6	1	
	12	..	Remove piston					2	2
						Total		63¼	44¾

Piston in the rough, 23 in. x 6½ in.; weight, 480 lbs.
Piston finished, 22⅜ in. x 6⅜ in.; weight, 400 lbs.
Metal removed, 80 lbs., cast iron.



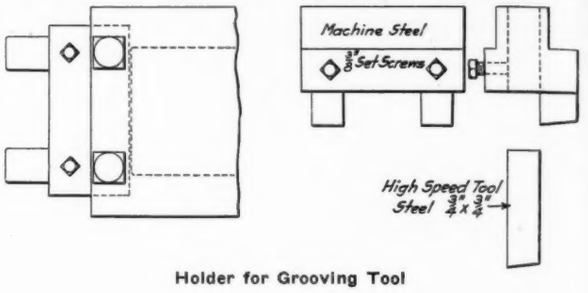
Reaming Cutter Ready for Use



Counterbore Used for All Sizes of Pistons by Changing the Cutter and Bushing

¼ in. adjustment in size. They are ground with an eccentric relief which prevents chatter and insures well finished work.

The grooving tool holder is made of a good grade of machine steel to fit the side head of the machine; the cutters are



Holder for Grooving Tool

of high speed tool steel, ¾ in. x ¾ in. and are so spaced as to cut both grooves at one operation. They can easily be removed for regrinding.

The body of the counterboring tool is made of machine steel. Different size cutters can be applied to the holder by removing the cap screw, plate and bushing; the latter should be the size of the hole to be counterbored.

[Similar practice in the machining of pistons on the Central of Georgia was described in the *American Engineer*, October, 1912, page 526. By combining operations Mr. Newman has apparently been able to considerably reduce the total time required.—Editor.]

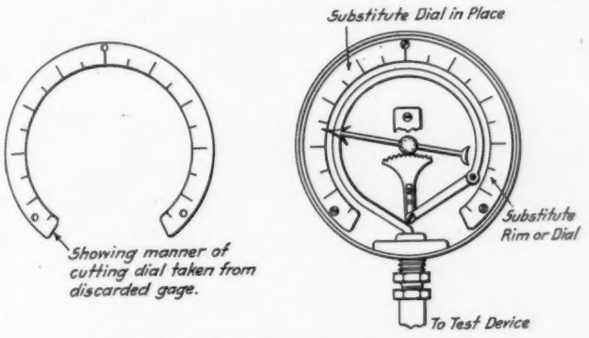
DIAL RIMS FOR ADJUSTING GAGE HANDS

By F. W. BENTLEY, Jr.
Machinist, Butler Shops, Chicago & North Western, Milwaukee, Wis.

Too much attention cannot be given to the adjustment of the travel of the hand on air brake and other gages. As the adjustment is largely an experiment in moving the sprocket slide to which the pull rod of the tube is attached, it is necessary to remove the hand and dial a number of times before the correct travel is obtained. Another method, that of marking the thin edge of the casing before removing the dial, is not commendable, as it mars the gage and the tip of the hand is also too far away from the edge of the gage to permit a close adjustment.

The accompanying drawing shows a method which gives good results. The dials of gages scrapped because of burst tubes, etc., are preserved and cut out in the manner illustrated so as to leave only the rim on which the figures are stamped. When the hand is placed on the spindle it can travel directly over the indications. As most railways use only a few of the best standard makes of steam and air gages, it is not a difficult matter to pro-

cure enough discarded dials to prepare in this way and which will exactly mate with the dial of any gage needing adjustment. The greatest part of the dial being cut away, it is an easy matter to adjust the sprocket slide without removing the hand or the dial while doing so. The use of the false rim renders the


Substitute Dial in Place
Showing manner of cutting dial taken from discarded gage.
Substitute Rim or Dial
To Test Device

Dial for Adjusting the Hands of Gages

whole interior of the gage perfectly accessible. Five or six of these rims made from the dials of scrapped gages will generally be sufficient to match the dial of any gage needing adjustment, and they have been found to be a great help in securing correct and rapid work.

SAVING TIME IN THE PAINT SHOP

BY CHAS. E. COPP
Foreman Painter, B. & M. Shops, Concord, N. H.

PAINT SHOP STAGING

Good staging is a necessary adjunct to a well-equipped paint shop for handling passenger equipment. Wooden horses and planks have served this purpose in former days, but the modern

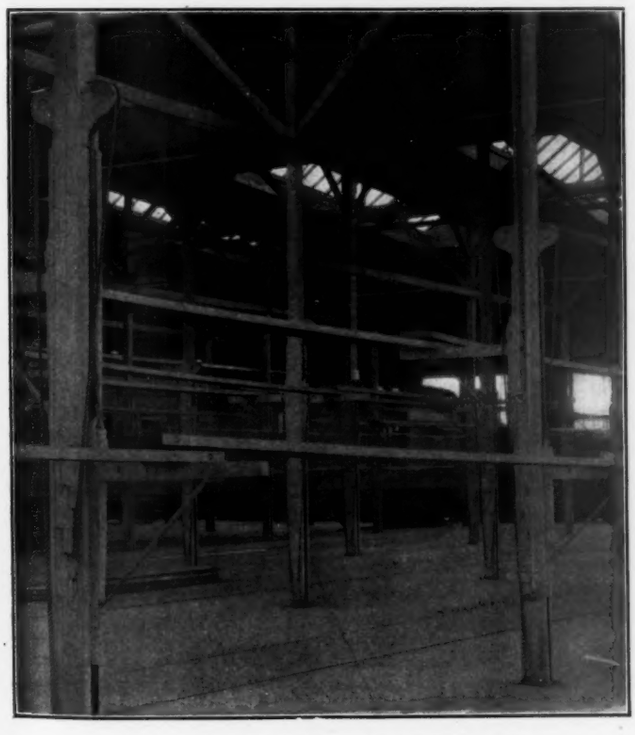


Fig. 1—Adjustable Staging for Painting Cars

shop is incomplete without some sort of a permanent staging to be hoisted by the men to the various heights required for performing their work. These stagings are usually constructed of iron and steel, with the exception of the plank that extends between the supports. Some are made partially automatic by counter-weights which run up on angle iron posts, and are arranged so that the men, with a touch of the foot, may release a dog or pawl that catches in notches in the edge of the angle iron provided for the purpose, allowing the staging to descend slowly to the floor or to the desired height for further work. A stage of this kind is in use at the New York, New Haven & Hartford paint shop at Readville, Mass., and also in the Boston & Maine shop at East Fitchburg, Mass.

Probably the most unique device is that in use in the Boston & Maine shops at Concord, N. H., a photograph of which is shown in Fig. 1. It was installed when the shops were first built about 15 years ago, and continues in use with good satisfaction to the present day. Oak cleats are screwed to the 5½ in. x 5½ in. shop posts and extend nearly to the height of the bracket containing the pulley over which the hoisting rope runs. These cleats are rabbeted on one side to form a runway for the post of the staging-bracket, which has a piece of iron at the top and bottom that runs in the rabbet. At the top of the bracket post and at right angles to it an arm is framed in and strongly braced, as shown. The top of the bracket-post is capped securely with an iron clasp and clamp combined, having an eye to which

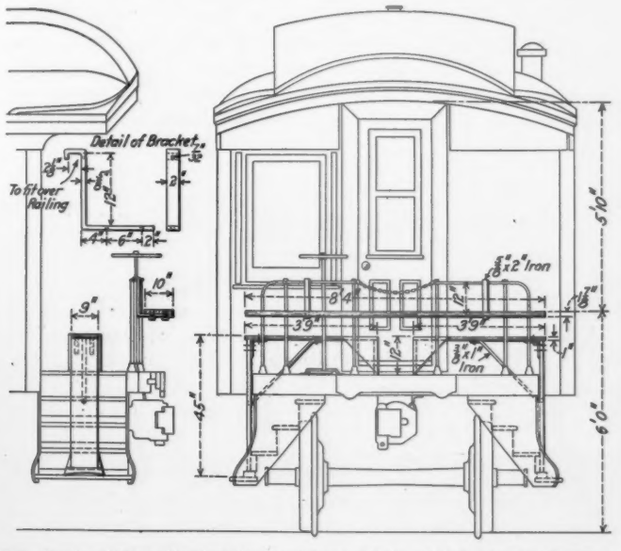


Fig. 2—Auxiliary Staging for Painting Ends of Passenger Coaches

the staging rope is fastened. This rope is passed over the sheave at the top and the other end provided with a link. A series of hooks at suitable heights are screwed to the shop-posts to receive the link on the end of the rope and hold the staging at the desired height. Greasing the grooves with lard oil or tallow and graphite facilitates the hoisting of the stage, which can readily be done by one man. When the stage is drawn to the extreme height it is mounted by a ladder. The planks overlap each other and are securely fastened to their position by small chains that pass through the bracket underneath, so that they cannot be drawn apart. They could be butted together by using a strong sheet-iron flanged bed-piece that should be screwed to the top of the bracket-arm. This staging can be constructed at small cost, as it is mostly made of wood, and it is to be commended especially for smaller shops where the expensive modern stage cannot be afforded. When this stage is hoisted to the top, or high enough to clear the head in walking, the floor is completely clear and trucks with car-cushions, sashes, etc., can be carted anywhere desired.

REMOVING PAINT FROM LOCOMOTIVE TANKS

Various means and methods have been in use for years for removing old paint from locomotive tanks, such as the lime and

potash method; blowing in live steam to heat them hot enough to blister it and scrape it off while hot (a terrible ordeal as long as it lasts); using paint or varnish removers; scraping them dry and cold; and lastly the sand-blast method. But perhaps the most novel and unique of all is the scheme recently tried out at the Boston & Maine shops at Concord, N. H. A 2-in. chisel, ground to an angle of about 45 deg., with a round shank of suitable size, is inserted in the tool holder of a pneumatic riveter, and the operator planes off the old paint rapidly.

AUXILIARY STAGING FOR THE PAINT SHOP

As desirable and beneficial as permanent staging is in the car repair and paint shops it falls short of making a complete outfit as it only meets the requirements for work on the sides of the cars. Something else must be brought into use on the ends. The use of horses and planks creates too much portable equipment about the shop, and for that reason the arrangement shown in Fig. 2 was devised and has been in active service for a number of years. The advantages of these platforms are their portability and the small amount of space they occupy. The platform stage is 3 ft. 9 in. long and 9 in. wide. The long leg is hinged to the horizontal portion and is held in place by a brace. The brace is held in place by a pin that may readily be removed when it is desired to close up the staging and stow it away. The staging used for working on the hood is simply a 10 in. plank fastened to and supported by two brackets made of 2 in. x 5/8 in. iron that hook over the platform railing. Split keys are inserted through holes in the brackets just under the rail to prevent the staging tipping up when a workman gets too far over on the end.

JIG FOR MACHINING ECCENTRICS

BY C. W. WARNER
Assistant General Foreman, Erie Railroad, Dunmore, Pa.

A great many sliding plate jigs give trouble because of the way in which the work has to be clamped on. In the jig shown in the illustration six pointed set screws are used to hold the work in position and by the slacking of three of the set screws

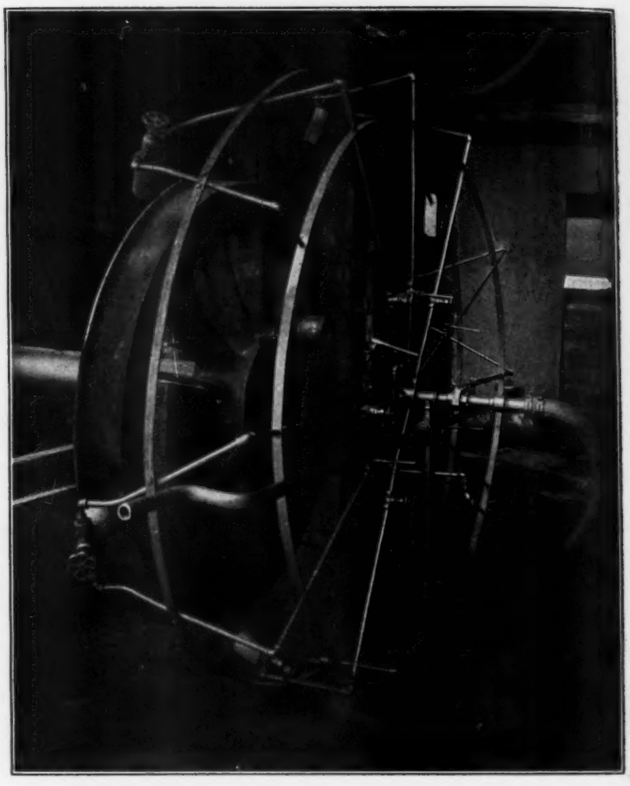
Jig Used for Machining Eccentrics

one eccentric may be removed and another placed in exactly the same position. This enables the changing of the work to be done very rapidly and also saves time in adjusting the position of the eccentric on the machine.

PORTABLE TIRE HEATER

BY H. E. BLACKBURN
Apprentice Instructor, Erie Railroad, Dunmore, Pa.

The portable tire heater shown in the illustration is made from pipe and pipe fittings with a cylinder head cover for a base. It weighs 110 lb. and can be easily carried about by means of the handles made of pipe. The six burners are controlled



Portable Tire Heater Made From Pipe and Pipe Fittings

by one air valve and each burner has a needle valve for oil control. This heater will remove an old tire in three minutes and heat a new one for application in five minutes, using about three gallons of fuel oil.

LOCOMOTIVES AS AN EMERGENCY BOILER PLANT.—When a manufacturing plant is confronted with the problem of replacing an old, inadequate battery of boilers with a new one of greater capacity, it is not a simple matter to make the change without interrupting operation. This condition was ingeniously met, when it recently became necessary for a Philadelphia plant to increase its source of power supply. An estimate showed electric power to be of prohibitive cost and the idea of utilizing locomotives for the purpose was suggested. The location of the plant made feasible the storage of locomotives on a long freight siding and two 4-4-0 type locomotives were obtained from the Pennsylvania Railroad, at a reasonable rental. While these were doing service, the old battery of two boilers was replaced with a new water tube boiler of large size. The process of locomotive boiler substitution was simple. The two old locomotives were hauled to a convenient point on the siding, after their tenders had been uncoupled; their throttle valves were closed, and a connection piped from the auxiliary domes to the main steam line in the plant. They were placed back to back, with an elevated platform between them, allowing sufficient space for two firemen and a coal supply.

POWDERED FUEL FOR RAILWAY SHOPS

Strong Draft Unnecessary; The Economy of Powdered Fuel, Fuel Oil and Producer Gas Compared

BY J. G. COUTANT

The value of powdered coal as a fuel in the iron and steel industry, as well as for steam boiler plants has long been known, but in spite of its many advantages and the apparent success of the systems of burning it, little progress has been made toward its general adoption. Quoting from Bulletin 16 of the Bureau of Mines:

"The use of powdered coal has passed beyond the experimental stage in Portland cement manufacture and in firing boilers in Europe and the United States. Manufacturers of improved forms of powder burners claim for a given type of coal, an increase of from 15 to 20 per cent in efficiency over common grate firing, and these claims seem to be warranted."

Some of the advantages obtained in burning powdered coal are:

(1) Complete combustion, doing away with losses due to the carbon contained in the ash and in the escaping volatile matter.

(2) Total absence of smoke.

(3) A cheaper grade of coal may be used.

(4) The plant may be rapidly forced above its rated capacity and sudden demands for power readily met.

(5) The labor of firing is practically eliminated.

(6) There is practically no ash to be handled.

(7) It is well adapted to the obtaining of high temperatures.

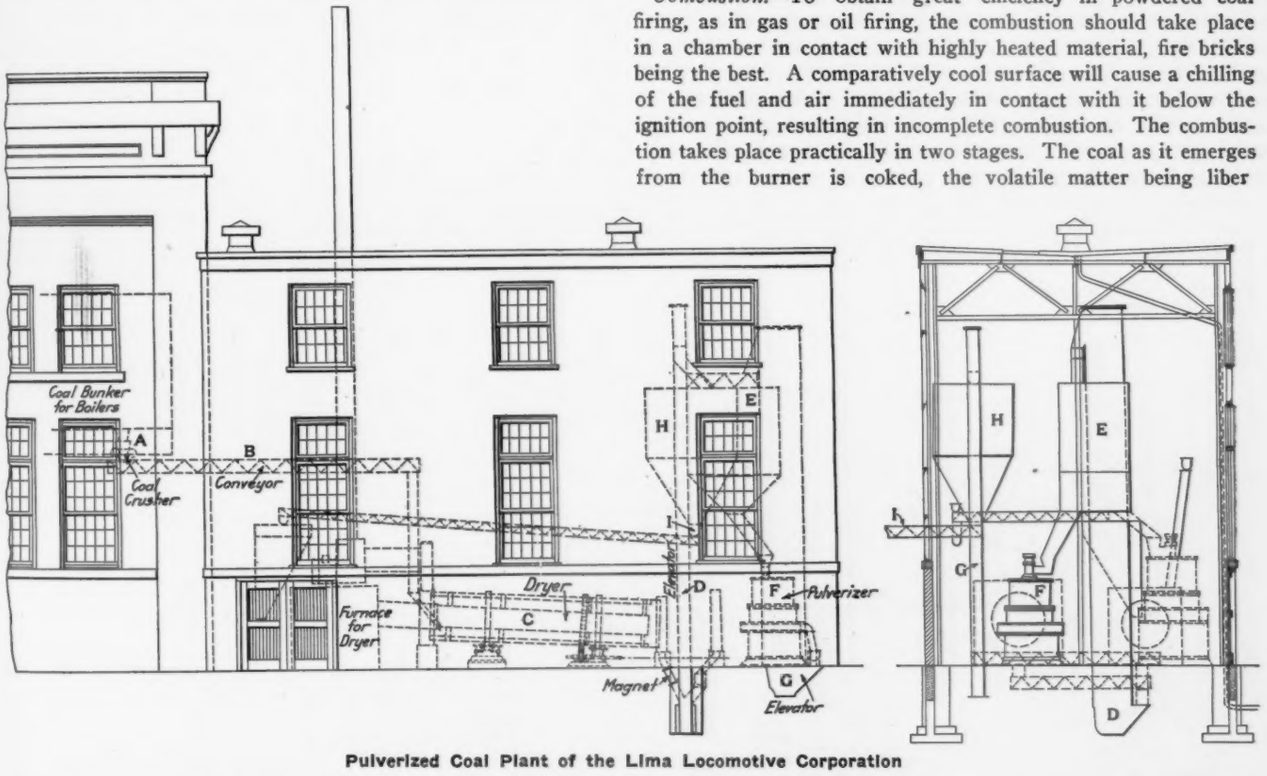
Coal.—Elaborate analyses and specifications as to the size and grade of bituminous coal and lignite to be used are unnecessary. Every essential requirement of the purchaser may be fulfilled by conforming specifications to the following characteristics: The coal used should contain not less than 30 per cent volatile matter, not more than 12 per cent ash, and not more than 1.25 per cent. sulphur

It is very desirable to purchase screenings or slacked coal on account of the advantage in price and to eliminate as much crushing as possible, although as a rule the percentage of ash increases as the size of coal decreases. If it is found that the coal contains too much ash or sulphur a great deal of this may be removed by washing. The calorific value of the coal is practically unaffected, the water taken up by the coal being removed by thorough drainage and by the coal dryer.

Coal containing as much over 30 per cent volatile matter as is possible is desirable; gas coal and lignites are to be preferred. The following analysis is of a West Virginia coal, which has given excellent results:

B. t. u, per lb	14,000	Ash	6.75 per cent.
Fixed carbon	58.00 per cent.	Moisture	1.25 per cent.
Volatile matter	34.00 per cent.		

Combustion.—To obtain great efficiency in powdered coal firing, as in gas or oil firing, the combustion should take place in a chamber in contact with highly heated material, fire bricks being the best. A comparatively cool surface will cause a chilling of the fuel and air immediately in contact with it below the ignition point, resulting in incomplete combustion. The combustion takes place practically in two stages. The coal as it emerges from the burner is coked, the volatile matter being liber ated and burned at once, while the solid coke is brought to a bright red before it ignites. During these successive operations the coal travels a large portion of the length of the furnace and the carbon is burned.



Pulverized Coal Plant of the Lima Locomotive Corporation

Draft.—A study of a number of tests of heating furnaces and boilers burning powdered coal shows that the necessary draft is very low and ranges from 0.01 to 0.4 in. of water and averages not far from 0.2 in. The low draft is recommended for this work because:

(1) A strong blast will carry the powdered fuel beyond the zone of combustion.

(2) The coal and air in a strong blast cause a sand blast action which cuts the brick work and increases the maintenance charges.

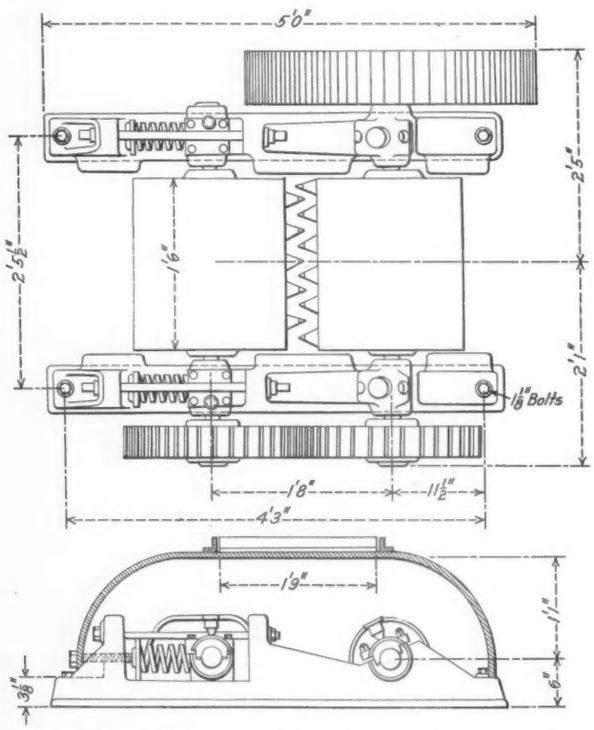
(3) A strong blast cools the lining by concentrating the fuel

and under these conditions it is impossible to maintain combustion.

Storing Powdered Fuel.—Cities have, up to recently, limited the storage of powdered fuel to such a small quantity as to prohibit the use of fuel feeders and hoppers, and it has been necessary to experiment with an apparatus for pulverizing and feeding direct to the furnaces. Coal dust mixed with air is often claimed to be of an explosive nature, but this is refuted by many engineers on the basis of experiments which show that explosions can only occur at temperatures high enough to drive off the volatile gases. Whether this is correct or not, the main points to bear in mind are: Avoid the accumulation of powdered coal on rafters and floors where it may be blown about by a draft; provide sufficient ventilation; and avoid a confined place in which the coal dust may become well mixed with air.

Comparison of Powdered Coal, Fuel Oil and Producer Gas.—Powdered fuel offers considerable economy over oil or gas firing. The heat obtained is also more intense than that which can be obtained from solid coal, oil or producer gas, if care is taken to preheat the air required for combustion. One barrel of oil contains 42 gal. and weighs from 310 lb. to 332 lb., according to the specific gravity. One cubic foot of pulverized coal weighs, loose 38 lb., packed 46 lb.

Assuming that 1 gal. of fuel oil contains 140,000 B. t. u. and 1 lb. of pulverized coal contains 14,000 B. t. u., the heat value of 1 gal. of oil equals that of 10 lb. of pulverized coal. These are



Spring Relief Coal Crusher Made by the Link Belt Company

good figures to remember for comparison. The following table gives comparative figures for oil and different grades of coal:

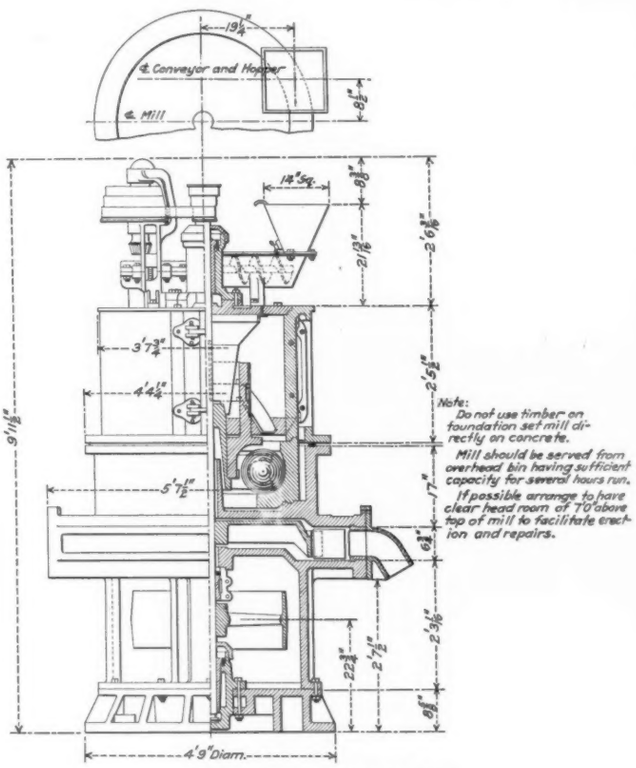
B. t. u. per lb. of pulverized coal.	Lb. of pulverized coal to 1 bbl. of oil.	Bbls. of oil to one short ton of pulverized coal.
10,000	588	3.40
11,000	534	3.74
12,000	480	4.08
13,000	452	4.42
14,000	420	4.76
15,000	392	5.10

In estimating the economy of pulverized coal, 35 to 50 cents a ton should be added to cover the cost of milling, as well as the fixed charges on the plant. There will be no other extra charge as the coal is as easy to handle as oil or gas.

Powdered coal has the further advantage over gas of doing away with the gas producer's inherent losses. These are considerable, for it is seldom that the thermal loss in the gasification of fuel by premature combustion, due to heat radiation and convection, is under 20 per cent of the available B. t. u.; to this should be added the loss due to carbon contained in the ash. A total loss of 30 per cent is a conservative figure for good practice.

Preparation of Powdered Fuel.—The work necessary in preparing powdered fuel has been one of the greatest obstacles to overcome. For proper combustion the coal must be practically free from moisture. It is first crushed to as small a size as possible and then must be pulverized so that 95 per cent will pass through a 100 mesh screen; after it is pulverized it must be kept dry.

These four operations are usually carried out in a separate



Fuller-Lehigh Coal Pulverizer

building called a milling plant. In order to outline the necessary equipment, the writer has been permitted to describe the powdered fuel plant of the Lima Locomotive Corporation, Lima, Ohio.

This corporation having found it necessary to use some other fuel than oil in the various furnaces, has installed a complete system for burning powdered coal and has erected a milling plant having a capacity of 3 tons an hour, adjoining the boiler room of the power house. This building is practically fireproof, is well ventilated and lighted, and is 55 ft. 10½ in. long, 26 ft. 8½ in. wide, 35 ft. high and is built with a light structural steel frame with a brick wall 8 ft. 6 in. high and corrugated iron above. The roof is of tile. Directly under the coal bunker in the boiler room a small coal crusher *A* has been placed. This crusher has a capacity of 5 tons an hour, but will run to deliver about 3 tons to the conveyor *B*. The object of this crusher is to crush the coal to ¾ in. size, in order that it will require less time to dry and also to increase the capacity of the pulverizing mill.

The conveyor *B* carries the coal to the dryer *C*, which has a capacity of 3 tons of coal an hour, the maximum moisture content of the coal being 15 per cent. The dryer reduces this to less than 1 per cent. The dryer furnace is designed and equipped for burning powdered or slack coal. The products of combustion pass through a brick lined flue to an inner shell at

a temperature of about 1,200 deg. F., through this shell to the rear end where they turn and pass back through the drying coal and through an exhaust fan to the stack at a temperature of 200 deg. F. The material is fed through the front head into the space between the two shells, picked up by the lifting buckets and dropped on the inner shell by the revolution of the machine until it reaches the rear end where it is raised by the elevator *D*. Great care should be given to the drying of the coal. When dry it requires less power to pulverize it and when pulverized will flow almost like a liquid so that there will be little danger of the dust clogging up pipes or hanging in hoppers. Further, as previously mentioned, the combustion of powdered coal takes place in a highly heated chamber where the volatile matter and moisture are distilled before the ignition of the fixed carbon; therefore if the coal contains moisture it will delay ignition and high temperatures in the furnace can not be obtained. The amount of moisture in the powdered coal should not exceed one per cent.

It is advisable to place an electric magnet on the chute leading from the dryer *C* to the elevator *D* to remove all iron from the coal, as it would be likely to damage the pulverizing mill.

The elevator *D* raises the dried coal to the bin *E*, which is of eight tons capacity. It is well to apply a vent to this bin to allow some of the remaining moisture in the coal to condense in the outside air. From the bin the coal flows by gravity to a feeder mounted on the pulverizer. This feeder is driven directly from the mill shaft by means of a belt. The grinding is done by four unattached steel balls which roll in a stationary, horizontal, concave grinding ring and the coal discharged by the feeder falls between the balls and is reduced to the finished product in one operation. The mill is fitted with two fans; the upper fan lifts the fine particles from the grinding zone to the chamber above while the lower fan acts as an exhaust and draws the finely divided particles through the finishing screen and discharges them to the elevator *G*. This machine possesses the maximum mechanical efficiency, is economical in cost of installation, operation and maintenance, and grinds coal containing 4 per cent moisture to 200 mesh.

To obtain the highest heat values and instantaneous combustion, coal should be pulverized as fine as possible. If 95 per cent will pass through a 100 mesh screen the quality is considered good.

The elevator *G* raises the pulverized coal to the overhead bin *H*, which is of eight tons capacity and which discharges to the conveyor *I*. This conveyor extends out of the building for loading the cars which distribute the coal to various points about the plant.

DEVICES FOR SHOP USE

BY LEROY SMITH

GANG PUNCH

The general arrangement and details of a gang punch and die for punching irons for making dead lever guides, or slack adjusters for trucks, is shown in Fig. 1. It will be noticed that only two holes are started at the same time, and as soon as they are fairly started and the starting strain is diminished, two more holes are started. The punch and die are designed to be used on No. 4 Hilles & Jones vertical shears and can be attached very readily.

DIES FOR FORMING SLACK ADJUSTERS

The shear and bending dies shown in Fig. 2 are used for making slack adjusters. The dies shown in the upper part of the illustration are used on a Hilles & Jones shear. They will

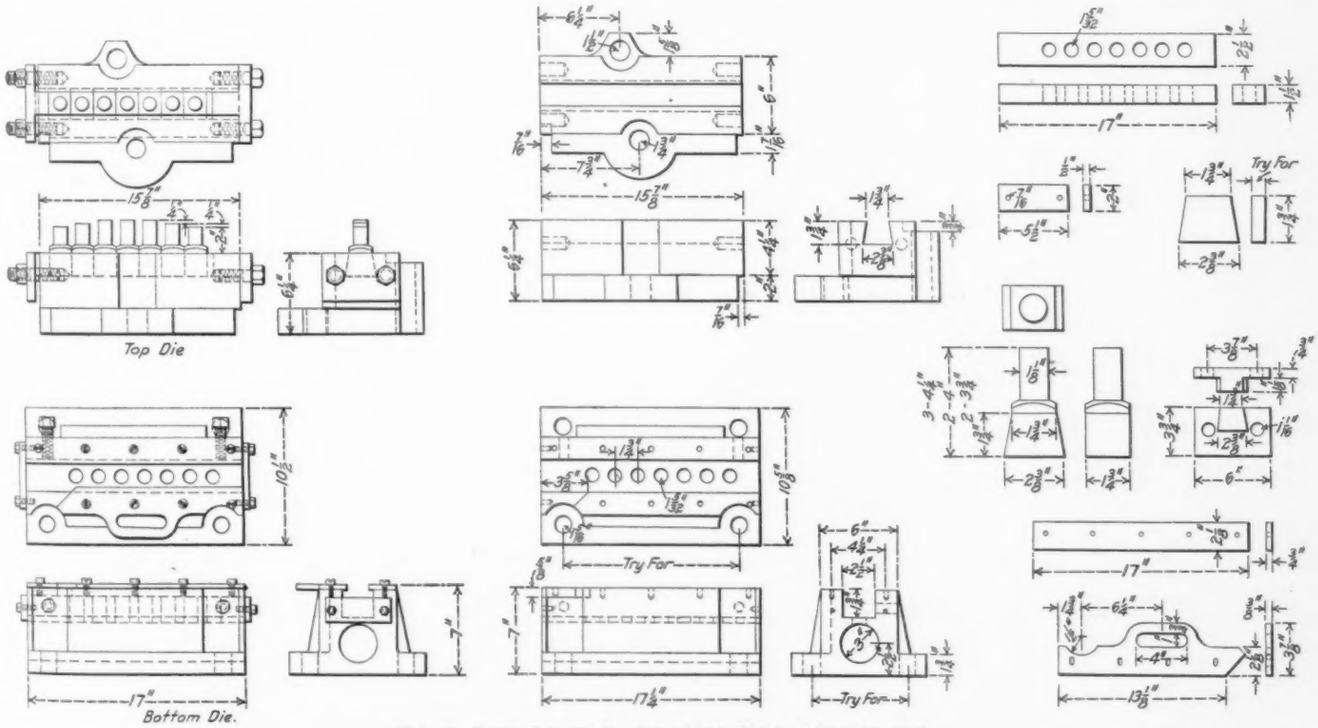


Fig. 1—Gang Punch for Punching Slack Adjuster Rods

cut the end of the rod round and punch the pin hole in one operation. After both ends have been completed the holes are punched as illustrated in Fig. 1 and the rod bent hot on the bending machine shown in the lower part of Fig. 2. For rods with bent ends, an extra operation will be required. This is done in the small die shown in the lower central part of Fig. 2. The die is placed under a 2,000 lb. hammer and the heated end of the rod is placed in the slot and bent to shape.

LAGGING PULVERIZING MACHINE

The general arrangement and details of a machine for grinding or pulverizing boiler lagging, so that it can be made into

a paste to be applied to portions of the boiler where it is impracticable or impossible to use slabs or forms to fit the curvature or fittings of the boiler, is shown in Fig. 3. For this purpose old or broken slabs are used to be broken or pulverized. The machine does away with the old hand method of breaking up the material and makes a very suitable material for the paste. With the exception of the four cast bearings, the machine can be built of material found at nearly every shop.

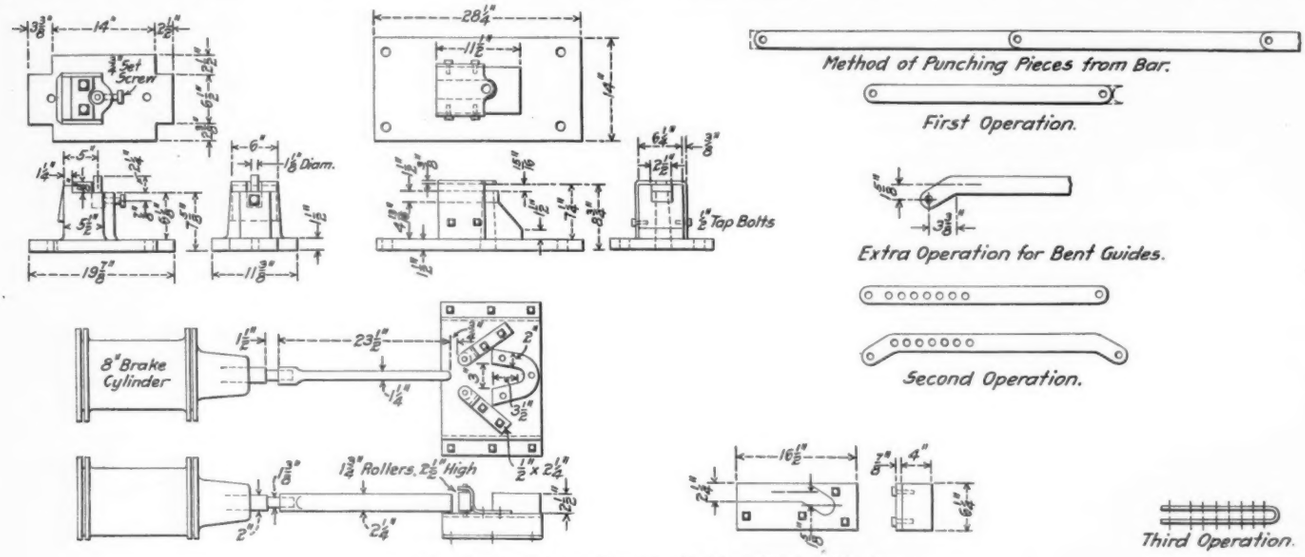


Fig. 2—Apparatus Used in Making Slack Adjusters

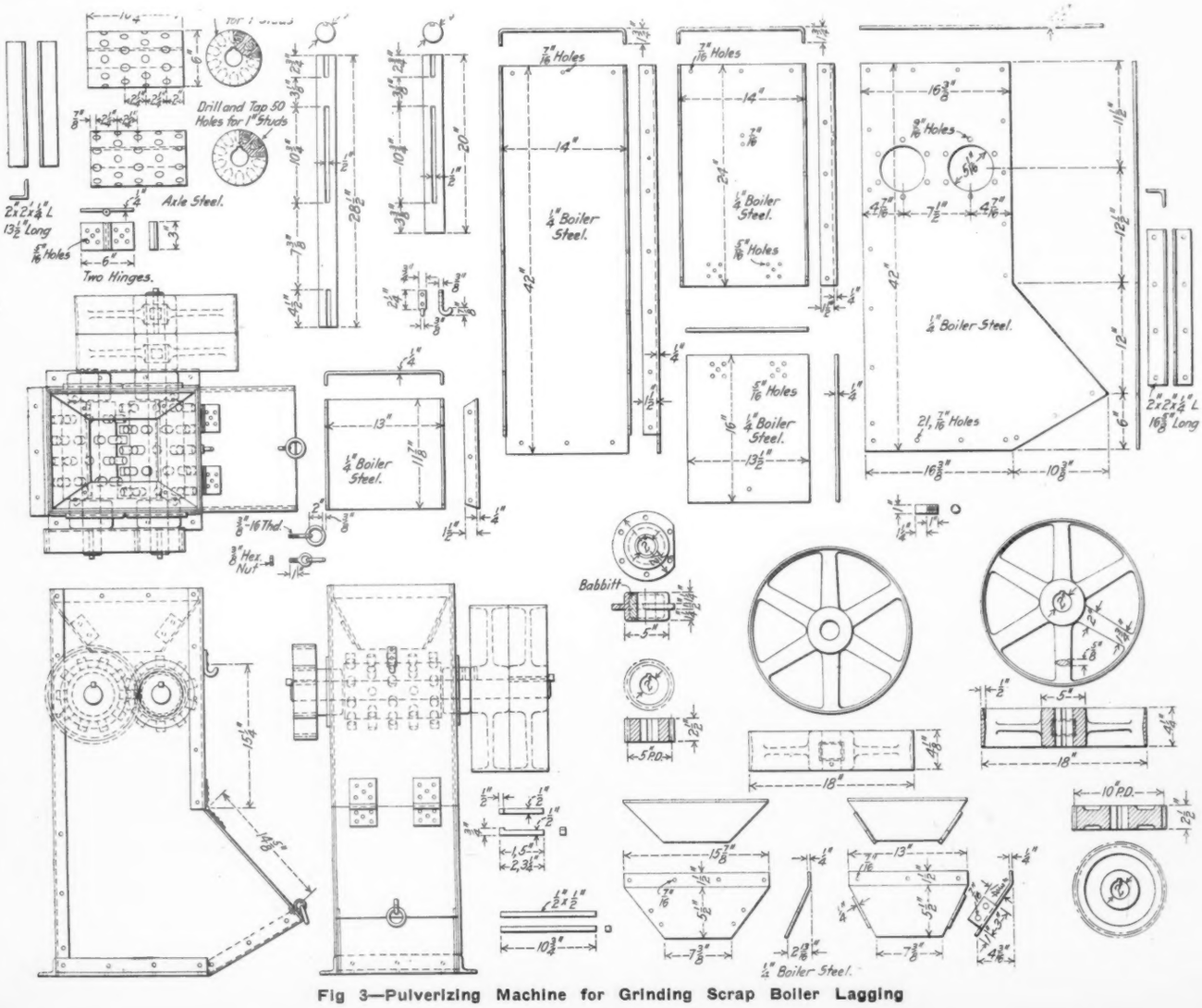
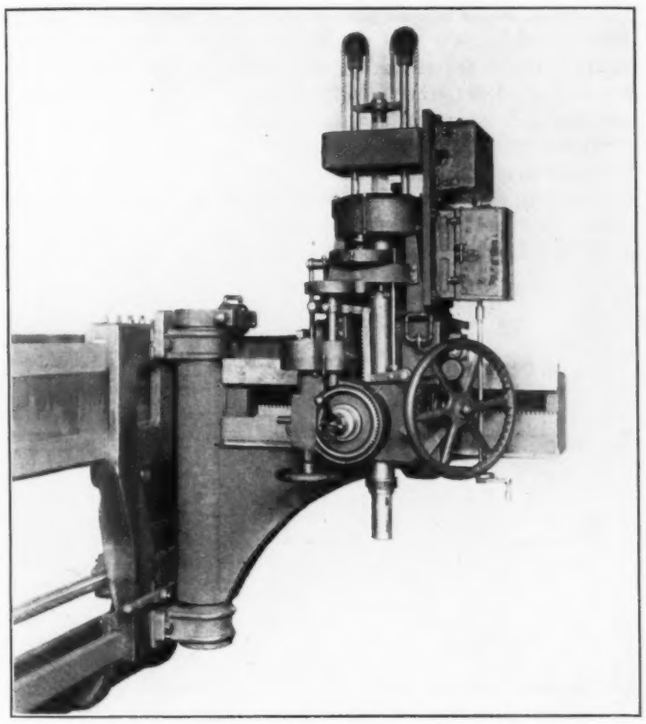


Fig 3—Pulverizing Machine for Grinding Scrap Boiler Lagging

NEW DEVICES

FOUR SPINDLE RADIAL DRILLING MACHINE

The powerful four spindle drilling machine shown in the accompanying illustration has been developed by Edwin Harington, Son & Company, Inc., Philadelphia, Pa., primarily for drilling holes in boiler plates and other similar parts in locomotive shops. Each of the heads has a capacity for drilling a 1½ in. hole at a cutting speed of 65 ft. per minute in steel plate.



One of the Arms of the Four Spindle Radial Drill

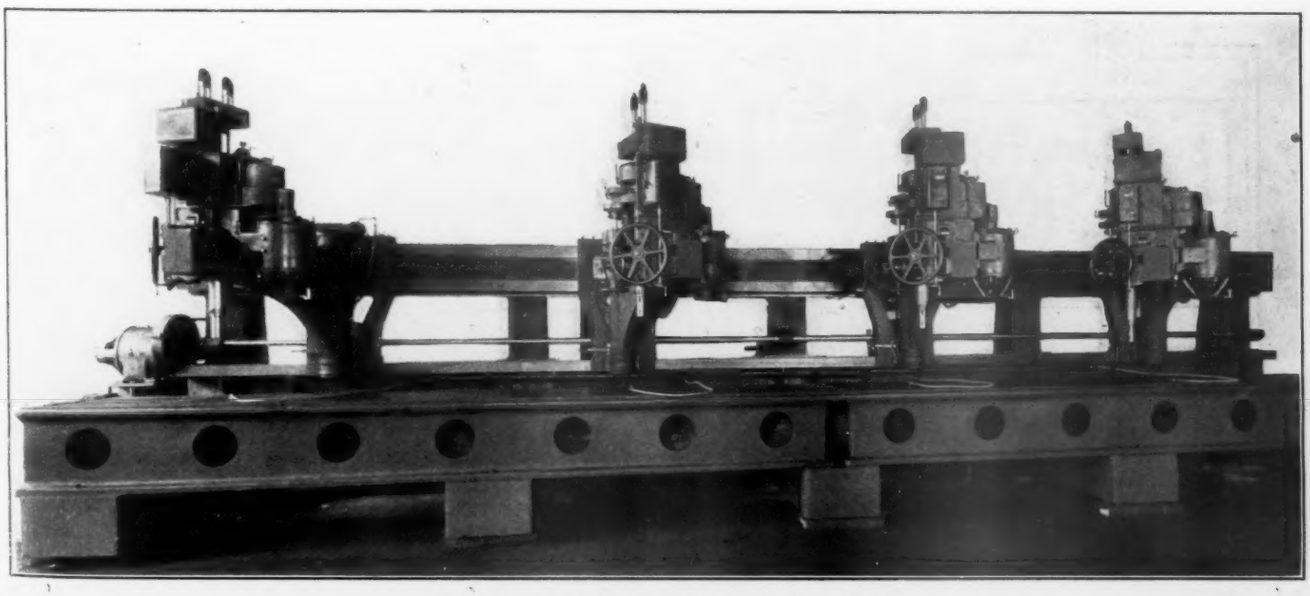
The four radial arms are mounted on one long cross rail and each has a power lateral traverse in addition to the radial and a 30-in. in and out movement of the arm and the spindle heads. Each head carries its own driving motor and all movements of each are controlled by the operator from his position in front of the spindle.

The spindle heads have adjustable steel rollers running on the wide top track of the arm providing easy movement by the hand wheel and worm in an angle rack. The variable speed, 7½ h. p. motor is mounted on the back of the head behind the arm and the controller handle is brought down behind the traverse wheel. The motors have a speed range from 825 r. p. m., to 1,650 r. p. m. The gearing from the motor has two changes by a positive tooth clutch operated by a lever on the left side of the head. The spindles have a large diameter, 2½ in. in the sleeve, and a squared upper end for the driving gear. They have a vertical traverse of 15 in., and a movement of 30 in. on the arm. Ball bearings are provided for the drilling thrust and under the counterweight yoke.

The feed has three changes by selective pin and is driven by gears from the spindle through a safety friction. Feeds from .005 to .015 in. per revolution are provided. A positive tooth clutch controlling the feed worm can be operated either by hand or automatic trip. A wheel is provided on the worm for hand feed and the rack pinion is connected to the worm gear by a quickly operated saw tooth clutch and hand lever for the spindle return.

The arms are of heavy box section and are mounted on the saddles by roller and ball-thrust trunnion bearings. The binder on the top trunnion is operated by air through a hose connection to a valve on the spindle head. The saddles have a long bearing on the top rail to prevent tipping, with a support against the lower rail for the thrust. The power traverse gearing is carried on each saddle, thus permitting independent motion in either direction by means of a double clutch between bevel gears. The 7½ h. p. motor for driving the traverse operating shaft is located at the left end of the base and has sufficient power to move all of the heads at one time.

The cross-rail is made double, the top part carrying the di-



Four Spindle Radial Drill for Boiler Shop Work

rect load and side strain, and the bottom taking the drilling thrusts. These rails are fastened on five heavy box section uprights which are mounted on a deep, ribbed, cast iron base running parallel with the cross-rail. Five cast iron sub-bases support both the cross-rail and table, and are to be bedded below the floor level.

The table is made in two parts joined in the center to make one continuous surface. It has a working surface of 30 in. by 40 ft. and is 24 in. high. Three T-slots run the full length and a large gutter is provided to drain to a tank in the foundation. The cutting lubricant is distributed by a motor driven pump to a flexible hose at each spindle.

The floor space required is about 9 ft. 9 in. by 43 ft. 4 in., and the overall height is 10 ft. 5½ in. The weight, including the motors, is 85,500 lb.

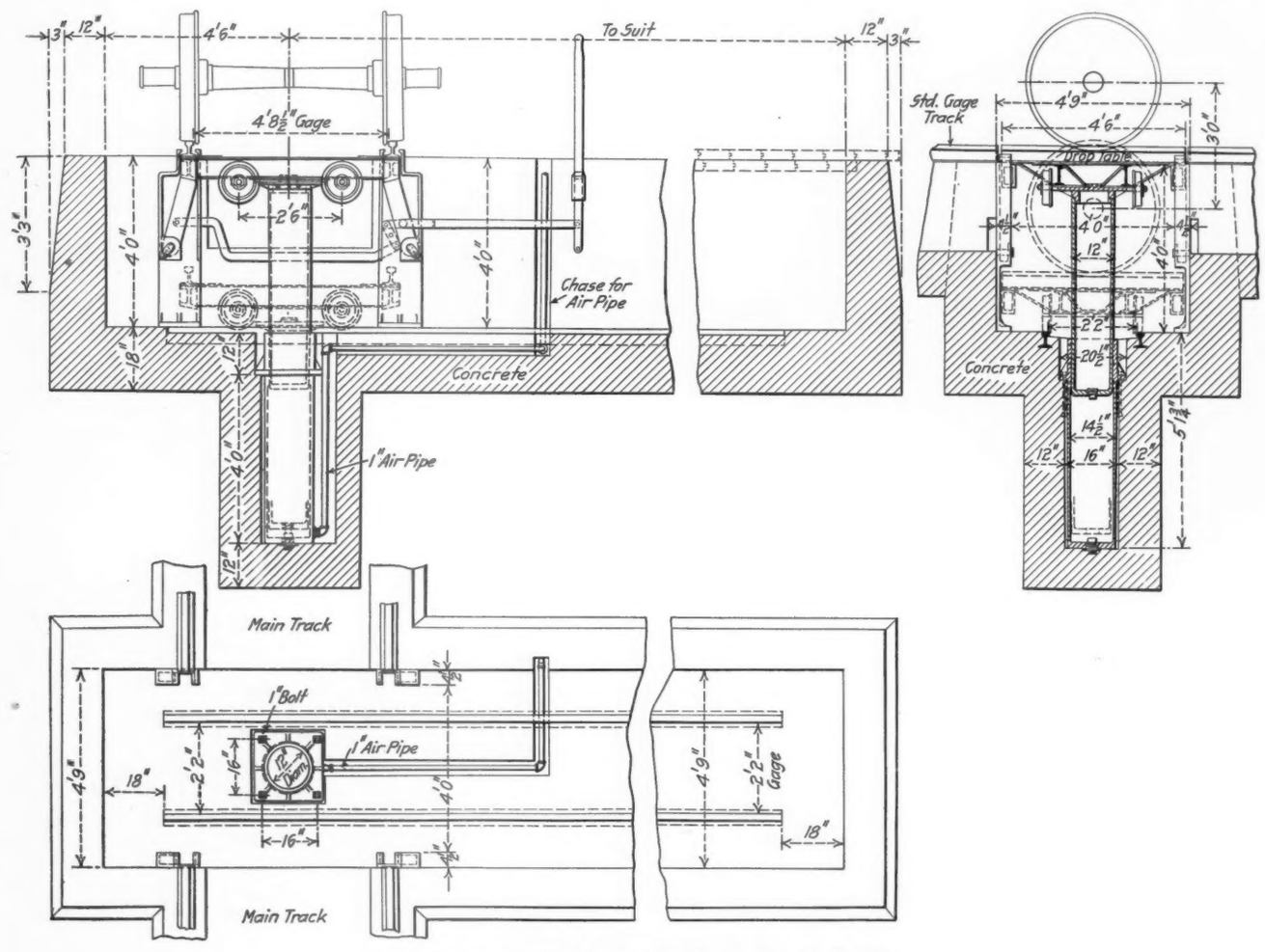
CAR WHEEL DROP PIT

An improved type of drop pit for removing and replacing car wheels at large terminals has been in successful use for some time on the Intercolonial Railway of Canada. It is manufactured by the Modern Drop Pit Company, Moncton, N. B.

This pit is operated by a vertical air jack 12 in. in diameter which obtains its supply from the ordinary yard or shop air line. The removable section of the running rails forms part of the steel framework that includes the wheels for moving the load transversely after it has been lowered. The large piston from the cylinder is not fastened to this car but carries at its top a broad base plate with a boss in the center, which rests on a suitably arranged plate on the bottom of the car. This makes it unnecessary to remove the sections of the running rails before lowering the wheels, as is usually the case with drop pits, since they form part of the car in this design.

The car with the sections of the running rails is held in the normal position in the track by four struts hinged at the bottom and extending diagonally inward as is shown in the illustration. These struts take a seat on an angle and are operated by a lever at one side of the track. At the bottom the struts rest in suitable pockets in the castings, which are supported by the concrete foundation. This makes the removable section of the track as solid as any part and the passage of heavy cars does no damage to the mechanism.

When it is desired to remove a pair of wheels they are located centrally over the removable section. The air is then turned on, the piston reaches the bottom of the car and takes the weight of the wheels and car from the four struts, which can then be swung back into the pockets at the side and the small car with the pair of wheels is lowered until it rests on the transverse track at the bottom of the pit. The piston then continues to sink and clears itself from the car, which is rolled to one side and the wheels are lifted from the pit by a crane or hoist. The car can then be run back over the piston, lifted in place and another pair of wheels removed or a new pair put in place as desired.

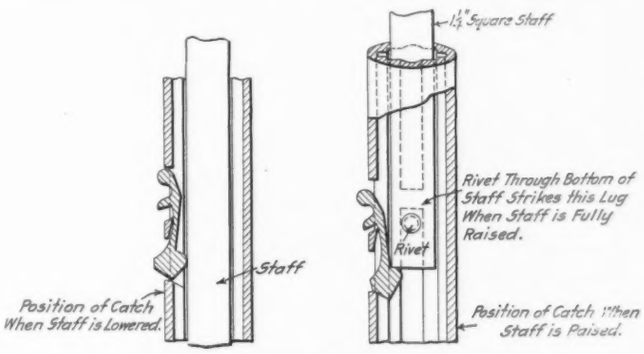


Improved Drop Pit for Removing Passenger Car Wheels

Bonus to Irish Railway Workers.—The directors of the Great Northern Railway of Ireland have voted a sum of nearly $50,000 to be distributed among the staff in the form of bonuses.

UNION DROP BRAKE SHAFT

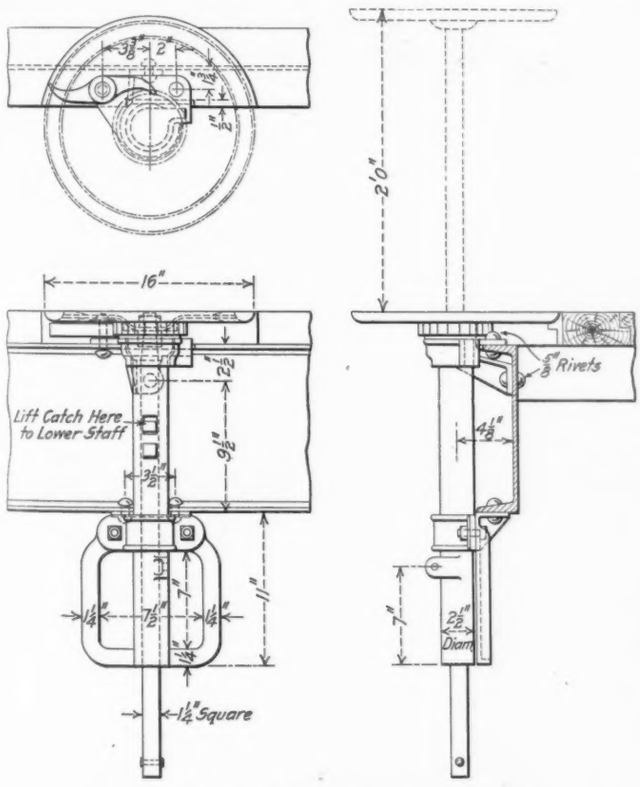
All railroads have experienced more or less difficulty in properly maintaining hand brakes on flat cars due to the brake shafts being damaged when the cars are loaded with long material, or on account of their being removed to accommodate the loading, and not replaced. This naturally causes a heavy expense and, under the present safety appliance laws, is very


1¼" Square Staff
Rivet Through Bottom of Staff Strikes this Lug When Staff is Fully Raised.
Rivet
Staff
Position of Catch When Staff is Lowered.
Position of Catch When Staff is Raised.

Sections Through Brake Staff Drum

serious, as the hand brakes must be maintained in an operative condition at all times.

The Union Railway Equipment Company, Chicago, seeking to eliminate these difficulties, has recently placed on the market a new type of drop brake shaft for flat and gondola cars. As shown in the illustration, this brake shaft is arranged to drop



Application of the Union Drop Brake Shaft

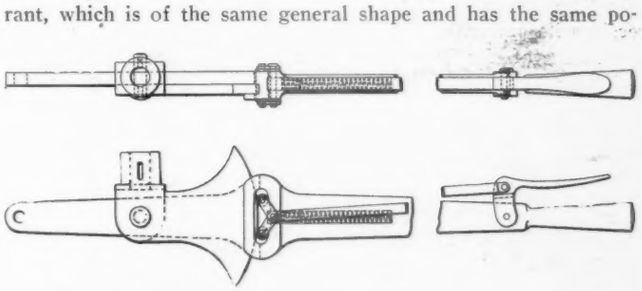
vertically by tripping the pawl located in the face of the malleable iron brake shaft drum. In the dropped position the hand brake wheel and the upper end of the shaft are flush with the top of the car floor, which will permit of loading the car with timbers, logs, structural steel or any long material without causing any damage to the brake shaft. The shaft is raised to the operating position by pulling it up by the hand brake wheel, the pawl in the drum locking it automatically in that position. A rivet, placed in the end of the brake shaft, strikes a lug in the brake shaft drum when the shaft is fully raised, thereby preventing it from being pulled all the way out. The design of the pawl is such that, when the shaft is fully raised, it will drop of its own weight to the locking position, from which it can only be released by raising it by hand from the exposed end.

The brackets, drum or sleeve, hand wheel, ratchet wheel and pawl, and chain guard are made of malleable iron, and the shaft is 1¼ in. square steel. The shaft is designed to meet all requirements of the United States safety appliance laws. It can be applied to old cars as well as new, and at no more expense than the old style shaft. The castings are furnished to suit any end sill construction, either wooden or steel.

ROLLER FRICTION CLUTCH FOR THROTTLE AND REVERSE LEVERS

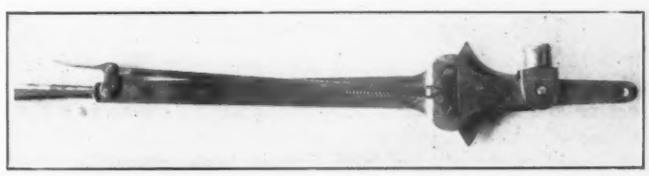
An objection has often been made to the notched quadrants on throttle and reverse lever riggings, because of the impossibility of obtaining a delicate adjustment of the throttle or of the cut-off, and the insecurity of the fastening after the notches become worn. James F. Howie, 910 Hoge building, Seattle, Wash., has perfected a clutch which aims to overcome these objections.

This type of roller friction clutch employs a flat faced quadrant, which is of the same general shape and has the same po-



Howie Friction Clutch on a Throttle Lever

sition as the usual notched quadrant, and a handle latch with a coil spring which is also of the arrangement now in common use. The throttle or reverse lever itself, is altered at the point of contact with the quadrant where it has been expanded and an opening cut through on both sides. This opening is flat on the bottom and inclined upward from both ends toward the center at the top. Two rollers are set in this opening and are connected by links at each end to the center pin where the connection to the latch is also made. This opening is in such a



Throttle Lever With a Roller Friction Clutch

position that the center of the quadrant slightly overlaps it and the rollers are of a size which gives them a wedge action between the quadrant and the lever as they approach the end of the opening.

Since there are two of these rollers, both acting in the same way but on opposite sides, it is evident that the wedge action will have no tendency to move the lever from the position it occupies when the latch is released, and furthermore, that

the gripping will be very secure and any tendency to move in either direction will only tend to increase the grip. It will further be seen that a very light spring, which means an easily operated latch, can be used and that the releasing of the rolls will be easily performed, allowing the lever to be conveniently adjusted.

The difference between the throttle and reverse lever construction is simply a matter of size, the principle being the same in both cases. This device is being manufactured by the Hofius Steel & Equipment Company, 908 Hoge building, Seattle, Wash.

CINCINNATI EIGHTY-FOUR INCH PLANER

In the design of its new 84-in. planer, the Cincinnati Planer Company, Cincinnati, Ohio, has included a number of new and original features which, together with the careful study of the proper placing of the controlling levers, has made this as easy to operate as most of the smaller machines. Rapid power traverse is provided for all the heads in any direction, and all movements are independent of each other and can be operated whether the table is in motion or not.

The motor on the top of the housings serves a four-fold purpose; it is used for driving the rapid power traverse and the feed to the heads; also for elevating and lowering the cross-rail and driving the pump which lubricates the ways. The pinion on the motor shaft engages a large gear on the horizontal rapid traverse shaft from which the pinion that drives the feed clutch receives its power. This is shown at the extreme right. Near the center of the horizontal shaft is a gear meshing with a pinion on the gear case of the elevating device, through which

Motor Drive for the Rapid Power Traverse and for Feeding the Heads; Also for Raising the Crossrail

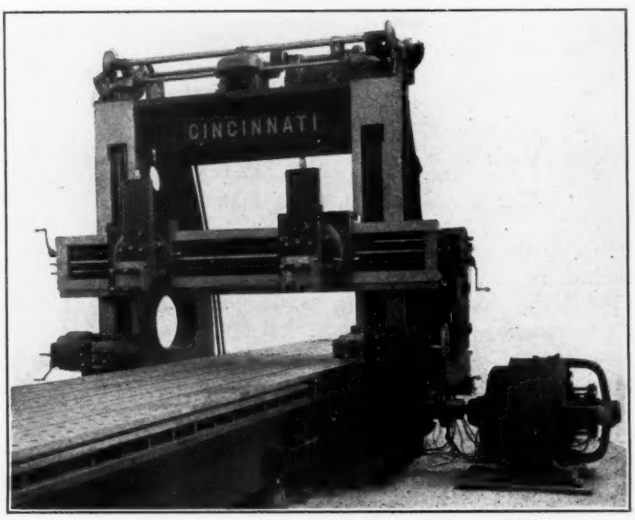
the power is transmitted for raising and lowering the cross rail. A lever from this gear case passes to the left side of the machine and controls the raising and lowering clutches in the gear case.

The feed of the tool heads receives its power from the driving clutch which has a connection to the bevel gear on the large horizontal shaft. The motion passes through the vertical shaft to a set of spur gears and to the trigger gears on the end of the rail and side heads.

The driving clutch is tripped by a rod which receives its motion from the tumbler and dogs on the side of the table and bed. The amount of feed is varied by the graduated slot heads which indicate the exact amount of feed at all times.

Rapid power traverse is obtained from a second vertical shaft on the side of the housing, very similar to the feed arrangement. The small handles shown on the end of the rail and side heads operate both the rapid power traverse and the feed. Turning these handles to the left engages the traverse and to the right, the regular feed, and in no case can both be engaged at the same time. The handle at the lower end of the rail is used for reversing the direction of the rapid traverse. All this is contained in the gear case at the end of the rail, and at no time is it necessary for the operator to step from his regular position for any of these changes.

All the gears are thoroughly guarded against accidents to the operator and all heads are taper gibbed throughout. The clapper boxes are clamped by a heavy clamp and three screws instead of the usual two bolts through a cored slot. The housings are of massive box form, tongued and doweled to the side of the bed and further fastened at the top by an arch of box



Improved 84-Inch Planer With Reversing Motor Drive

form closed on all sides and open only at the ends where it fastens against the housings.

The ways of the bed and table are oiled by forced lubrication from a pump at the back of the housing.

All driving gears are of steel and the pinions and table racks are of steel forgings.

The illustration shows the machine with a reversible motor drive. The motor is connected directly to the driving shaft through a flexible coupling. The controller is mounted on the housings. Ten cutting and ten return speeds are available.

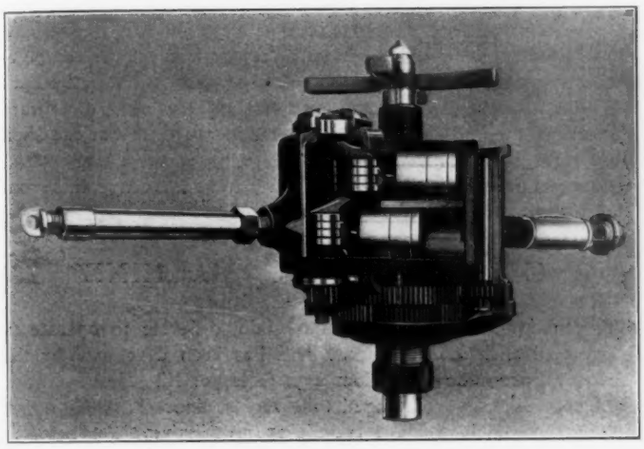
PNEUMATIC DRILLS EQUIPPED WITH ROLLER BEARINGS

An improved type of "Little David" pneumatic drill has recently been brought out by the Ingersoll-Rand Company, 11 Broadway, New York. This drill has connecting rods running on roller bearings combined with crank shafts running on ball bearings.

The shell is so designed that the entire motor apparatus may be assembled or dismantled through the crank case by the removal of the cover. The motor or engine is of the angular four-cylinder, single-acting, reciprocating piston type, each pair of pistons being attached to opposite throws of a double crank shaft, and acting in balance. All four connecting rods are exactly alike and are interchangeable. Each consists of but a single part made by drop-forging a piece of selected steel. The connecting rods run on Hyatt roller bearings and are attached to the pistons by spring arrangements which facilitate assembling. The piston ends of the rods are ball shaped and the flat steel springs are slipped over them. These balls have their bearings

in the centers of the pistons, forming ball and socket joints, permitting the connecting rods to yield to pressure from any direction without causing the pistons to bind in the cylinder. This construction also permits the pistons to turn in the cylinders so that wear is evenly distributed.

The crank shaft works on ball bearings of the separator type, which, it is claimed, is superior to the full type of bearing for machines of this character operating at medium and high speeds, as in the full type of construction the balls come in contact and

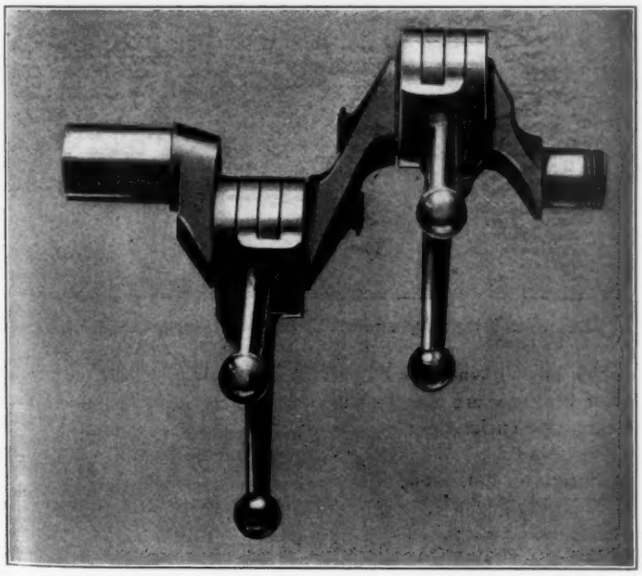


Part Sectional View of the Little David Drill

wear flat rings on their circumferences in a short time, resulting in loose bearings and generally unsatisfactory operation. This rapid wear is largely due to the fact that the balls are rotating in opposite directions at their points of contact.

The spindle is provided with a ball thrust bearing interposed between the shell and feed spindle in such a manner that the main frame is relieved of all strain.

Each valve controls two pistons which act on alternate strokes.



Roller Bearing Crank and Connecting Rods

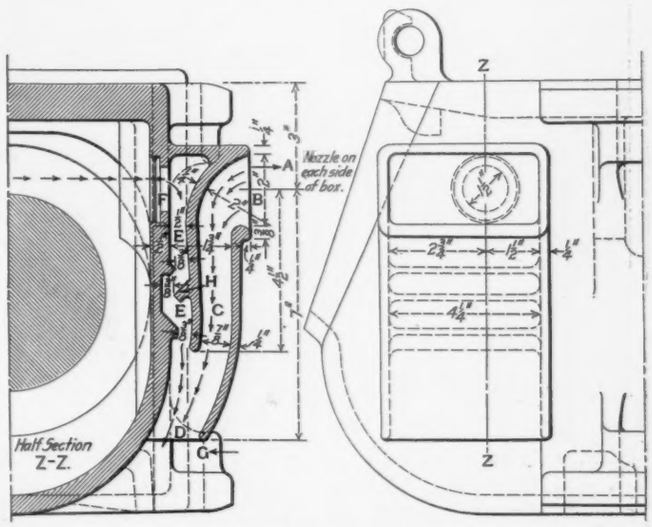
They are geared to the crank shaft through a spindle gear. The valves are of steel, are hardened and ground and operate in bronze bushed chests.

These tools may be made reversible or non-reversible at the will of the operator. This is accomplished by changing the position of a sliding sleeve on the throttle handle. With the exception of the light wood-boring type, all sizes are provided with compound gearing, insuring great power at all speeds.

AIR VENTILATED JOURNAL BOX

A car journal box which will permit the passage of a current of air over the journal and around the brass, without allowing the admission of foreign matter, has been patented by W. E. Crist, of Baltimore, Md. The illustration shows a construction for a 5½ in. by 10 in. M. C. B. journal box, and is typical of the arrangement for any size.

It will be seen that the current of air caused by the movement of the train does not enter the journal box, but, by its passage through a duct on the side, it causes an induced current outward from the forward side of the box as is shown by the arrows. For instance, if the car is traveling in the direction shown by the arrow *A* the air enters the mouth of nozzle *B*, passes down through the outer port *C* and discharges at the bottom of port *D*. This causes a partial vacuum in the inner port *E* and through the vent *F* to the inside of the box. As the nozzles are on both sides of the box, the heavier atmospheric



Journal Box Arranged for Induced Ventilation

pressure on the outside will cause a moderate flow of air into the box through a similar port *E* and vent *F* on the other side. The air passing over the bottom of the nozzle at *G* also tends to increase the vacuum. Baffles *H* are inserted in the inner port as an extra precaution to prevent any foreign matter such as cinders, etc., entering the vent.

It is evident that when a train is moving this arrangement will cause a continuous, slow passage of air through the journal box and around the journal and bearing. It is believed that this will have enough cooling action to prevent hot boxes.

POCKET SLIDE RULE

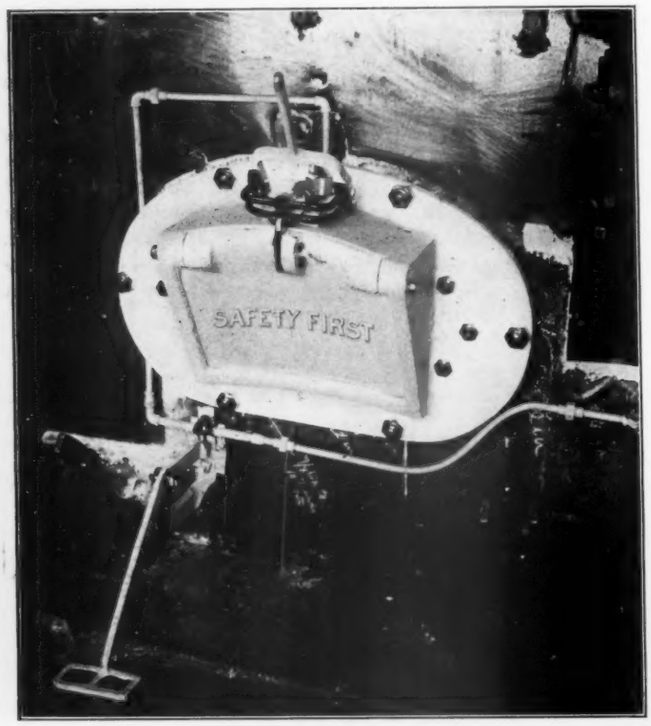
A circular slide rule of pocket size has been devised by Lucien E. Picolet, 19 South Ninth street, Philadelphia, Pa. This rule is made of pyroxyline, a material frequently used for draftsman's triangles. It has a diameter of 2¾ in. and a thickness of 3/32 in. It performs the operations of multiplication, division and the extractions of square and cube root. It is made with either of two scales. One scale is a direct arrangement for multiplication, division and square root in the usual way, and the other is inverted and has an auxiliary scale or cube root. The rule can be obtained with both scales if desired. This is a practical instrument which is claimed to be equivalent to three-place logarithms in precision.

CHANNEL PASSENGERS.—The cross-channel passenger traffic via Dover and Folkestone last year was 1,100,529.

LOCOMOTIVE FIRE DOOR

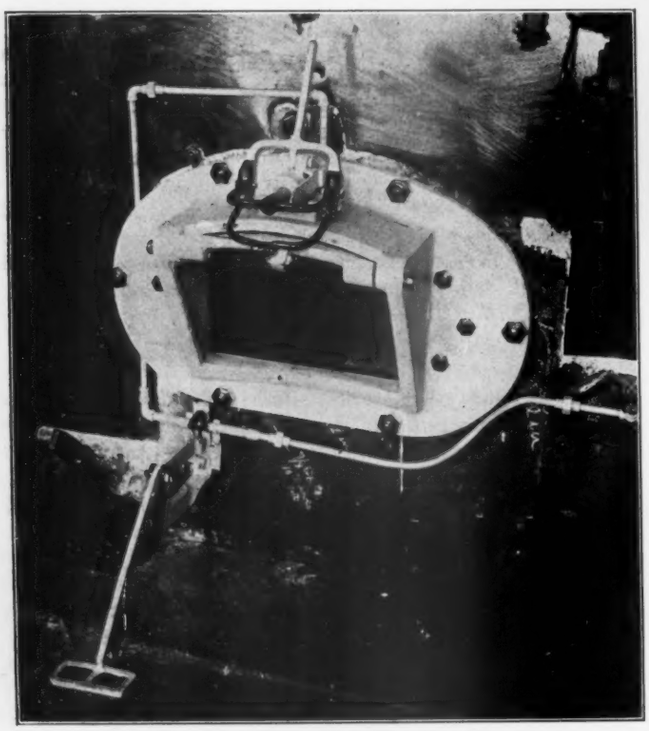
A new type of locomotive fire door which has creditably passed severe tests on the Ann Arbor Railroad is shown in the accompanying illustrations.

It is hinged at the top and swings inward, being normally



Door Closed and Held in Position by Gravity

operated by an air cylinder located on the shelf directly above the door. When closed, it rests against the inside of substantial flanges on both the sides and the bottom and, when opened, swings to a horizontal position inside the casing. In the closed position, it rests at an angle so that it is held in place by gravity.



Door Swung Inward Around Hinge to the Full Open Position

A hand operating device is provided in connection with the air cylinder and the door can be manipulated in the roundhouse when there is no air pressure on the locomotive or by the fireman in case of a break in the air line or other trouble. A lock is also arranged to hold the door in the open or the closed position as may be desired.

The air cylinder used is 2 in. in diameter and has a stroke of 5½ in., and is operated by a spring seated valve controlled by a foot pedal conveniently located as shown in the illustrations.

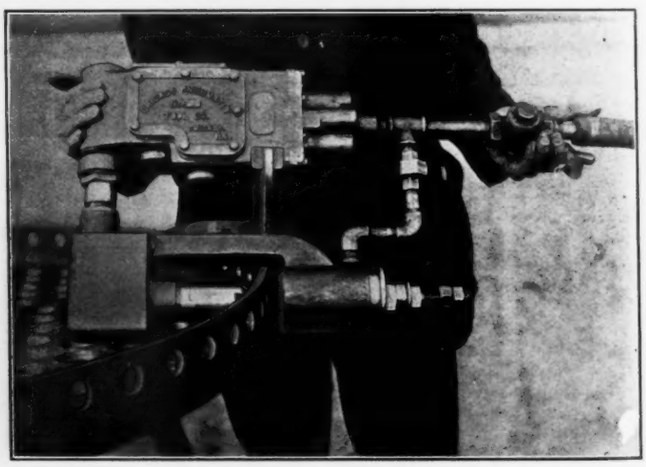
The advantages of this construction lie in the fact that in case of a broken arch tube or boiler tube, it will prevent the escape of steam or hot water to the cab. Furthermore, when in the open position it tends to deflect the air entering the door downward and under the arch. It has a further advantage in that the shelf over the top protects the fireman's face from the heat.

Application has been made for a patent covering this construction.

COUNTERSINKING MACHINE

A combined drilling and countersinking device to operate in connection with a Little Giant drill has been developed by the Chicago Pneumatic Tool Company, Chicago, Ill. It is intended for countersinking on flanged tube sheets, door sheets, I-beams, etc., and is self-contained, requiring no rigging, back stop or feed screws.

The general arrangement of the machine is well shown in the illustration, where it will be seen that the feed is automatically regulated by means of an air chamber or push-up device



Device for Drilling and Countersinking Holes in Flanges

which has a connection directly to the air line behind the motor. Ball bearings are used throughout the device and the beveled gears are enclosed in an oil-tight chamber. A No. 4 Morse taper spindle is provided and the device is kept from turning by means of lugs which fit around the housing.

This machine weighs 35 lb. and it is claimed that flanged tube sheets may be countersunk at the rate of two holes a minute, as compared with a rate of one hole every two minutes under present methods.

NATURAL GAS IN THE UNITED STATES.—The Geological Survey reports that the consumption of natural gas exceeded all records in 1912, having amounted to 562,203,452,000 cu. ft., valued at $84,563,957, or an average of 15.04 cents per 1,000 cu. ft. The corresponding consumption in 1911 was 512,993,021,000 cu. ft., valued at $74,621,534, or an average of 14.55 cents per 1,000 cu. ft. in 1911.

NEWS DEPARTMENT

For the purpose of reducing the number of accidents at highway crossings the Chicago & North Western, at the recommendation of its Central Safety Committee, is putting up a large number of special warning signs 400 or 500 ft. from the track at crossings where the view of approaching trains is materially obstructed. Approximately 500 of these signs have been set up at crossings in Illinois and Iowa.

The Union Pacific has abolished the title of assistant general manager held by the heads of departments on the general manager's staff under the Hine system of organization, retaining the distinctive titles of superintendent of motive power and machinery, chief engineer, superintendent of transportation, etc. Under the statutes it is necessary to have a distinctive title for some departments. Heretofore the road has used both titles and only the one legally required is to be retained. There will be no change in work or responsibilities.

Not a single passenger out of 111,000,000 carried by the Pennsylvania Railroad in 1913 was killed in a train accident. Reports for the past six years show that almost 600,000,000 passengers have been carried by the Pennsylvania, and but 16 of them lost their lives in accidents to trains; nine were killed in one accident. In six years, out of approximately 5,000,000 trains operated, about 1,370 a day—only five have been involved in wrecks which caused the death of any of the passengers carried on them. Three of these years were entirely free from train accidents causing the death of passengers.

A whole mountain of earth is being sent East from California over the Southern Pacific. It is situated near Lompoc, but the state of Pennsylvania wants it and is willing to pay the price for it, so that it is being shipped a matter of 3,000 miles by rail at the rate of 15 cars, or 750 tons, a month. When the last car has gone out an accurate indication will be had of what a mountain actually weighs. The earth is of a very peculiar consistency, and is supposed to be the result of gradual decomposition for ages past of millions of sea shells. For commercial use, the only process it goes through is grinding. It is sold in the East as infusorial earth, and has high value for insulating purposes in the electrical industry.

A CORRECTION

The caption under the upper illustration in Mr. McManamy's paper on page 13 of the January issue should be "Result of a Boiler Explosion Caused by Low Water."

THE TELEPHONE VOICE

The "campaign of politeness" on the Southern Pacific includes little placards attached to the telephone stands in the offices of the company. These "reminders" convey the following advice: "When you answer the telephone, be pleasant. It costs you nothing and in your heart you want to be liked. As you take off the receiver, say, 'Southern Pacific,' and then give your name or department. It saves time. Said pleasantly, it is a good advertisement for yourself and the company. Thank the man who helps you or gives you information—he likes it. Remember, on the telephone, the voice is everything. See that it is friendly."

SAFETY FIRST ON THE NEW HAVEN

A "safety first" meeting was held at Boston on Sunday, January 25, at which over two thousand men were present. They were addressed by Howard Elliott, chairman of the board of directors of the New York, New Haven & Hartford; James H. Hustis, president of that road, and other officers. Mr. Elliott said: "You have been accustomed to working with a list of 'don'ts' and I shall now give you a list of 'do's.'

"Do be careful. Do be alert and efficient. Keep always in god mental and physical health. Do be loyal, and stand up for the railroad in a manly fashion. Be ready always to give courteous and direct answers to the public. Show the public that it has a duty toward us."

Mr. Hustis, in the course of his address, said: "Charges have been made that organized labor was in part responsible for the terrible accidents that have taken place on our railroad. I want to take this opportunity to say that organized labor, as such, cannot be charged with intentionally taking a position that will tend to increase accidents."

PROPOSED STANDARD SIZE OF CATALOGS

Most catalogs at the present day are valuable, and are supplied to a carefully selected list of men to whom their contents will be of practical assistance. In the mechanical field particularly a great reliance is placed on the file of catalogs maintained, which in effect becomes a reference library. When one considers the multiplicity of sizes in use, the advantage of a standard size is at once demonstrated. A committee appointed by the Technical Publicity Association to investigate and recommend standard sizes for catalogs, recently measured 927 catalogs and found 147 different sizes, ranging from 3 in. by 5 in. to 11 in. by 14¼ in. This matter has been under investigation by the committee of the Technical Publicity Association for the past 18 months, and its investigations have led to the recommendation of 6 in. by 9 in. and 8½ in. by 11 in. for standards for all purposes. Both of these sizes will cut to very good advantage with a minimum of waste from catalog papers now carried in stock by paper manufacturers. Another advantage of the larger size is that catalogs of these dimensions can conveniently be filed with correspondence, as this size will very nicely fit standard filing cabinets.

BALTIMORE & OHIO SAFETY COMMITTEE

The Baltimore & Ohio has reorganized its "safety-first" work and has established a general safety committee of seven members who are to give their whole time to this work. The chairman is J. G. Pangborn, and the other members are E. R. Scoville, John Hair, W. M. Bond, J. P. Campbell, Dr. E. M. Barlett and B. C. Craig. The three men who have been managing the safety-first work during the past three years, Messrs. Boyd, Coon and Tearney, are now an advisory committee. The new general committee will visit each division of the road on one day each month, to confer with local committeemen and to inspect the property. Major Pangborn is the well-known historian and former traffic officer of the Baltimore & Ohio. Mr. Scoville was for 12 years a division superintendent west of the Ohio river. Mr. Hair has been in the mechanical department since 1897 as master mechanic and superintendent of motive power. Mr. Bond was formerly a division engineer, Mr. Campbell a station agent and Dr. Barlett in the relief department. Mr. Craig for the past nine years has been inspector of safety appliances in the employ of the Interstate Commerce Commission.

PASSENGER TRAINS ABOUT SAN FRANCISCO

The great number of Southern Pacific passenger trains operated daily within a radius of 50 miles from San Francisco is shown in figures compiled in the office of General Superintendent J. M. Davis of the Central District. On the Coast line—San Jose, San Bruno, Mayfield, Los Gatos—there are 73 trains daily, from Monday to Friday; 74 on Saturdays and 55 on Sun-

days. On the Transbay lines—Oakland through Port Costa; Oakland-Niles-Newark; Redwood-Niles and Niles-San Jose—there are 86 daily from Monday to Friday, and an equal number on Saturdays and Sundays. On the Vallejo-Suisun-Calistoga-Santa Rosa there are 24 daily.

On the electric suburban system there are 1,156 trains handled daily between Monday and Friday; 1,205 on Saturdays and 1,180 on Sundays.

On the steam suburban lines—Shellmound to Richmond and to Stonehurst—there are 34 daily except Sundays, when there are 31.

The total is 1,373 daily between Monday and Friday; 1,423 on Saturdays and 1,376 on Sundays.—*Southern Pacific Bulletin.*

REPORT ON SMOKE ABATEMENT IN CHICAGO

The Chicago Association of Commerce Committee on Smoke Abatement and Electrification of Railway Terminals has submitted a report to the association stating it has practically completed its investigation of the situation with respect to smoke in Chicago, but it has not completed its studies as to the remedy. The report says in part: "Meanwhile the committee is actively at work upon a program of study and design touching the important problems affecting the technical practicability and the cost of complete electrification. This is a problem presenting many details, each one of which is receiving careful and systematic attention.

"Studies are being made also concerning the financial practicability of carrying out the necessarily extensive program for electrification of the railway terminals of Chicago, in the event that such electrification shall be recommended in the committee's report.

"In conclusion, it may not be amiss to say that most of the materials necessary to solve the question of the necessity for the electrification of Chicago's railway terminals and the mechanical feasibility of such electrification are in hand, but that the information so far gathered as to the financial practicability of such an undertaking is not sufficient at the present time to enable the committee to determine this phase of the problem."

MEETINGS AND CONVENTIONS

Master Boiler Makers' Association.—The eighth annual convention of the Master Boiler Makers' Association will be held at the Hotel Walton, Philadelphia, Pa., which will be headquarters, on May 25, 26, 27 and 28, 1914.

American Society of Mechanical Engineers.—A paper on Brake Performance on Modern Steam Railroad Passenger Trains will be presented by S. W. Dudley, assistant chief engineer, Westinghouse Air Brake Company, Pittsburgh, Pa., on Tuesday, February 10, 1914, at 8:15 p. m., at 29 West Thirty-ninth street, New York. The data to be presented are the result of important tests made by the Pennsylvania Railroad, in conjunction with the Westinghouse Air Brake Company, during the past year. Among the more important topics are the following: The maximum percentage of emergency braking power which can be adopted; a comparison of the relative performance of the clasp brake rigging (two shoes per wheel) and the standard brake rigging (one shoe per wheel) under corresponding conditions; a comparison of the performance of the improved brake mechanism (type U C) with that of the commonly used "high speed" (type P M) brake equipment; behavior of brake shoes as tests progressed and any variation in the result of similar tests which cannot be accounted for by known changes independent of the brake shoes; and the coefficient of friction between the wheel and the rail under varying weather conditions. After the presentation of the paper the meeting will be open for discussion. An informal dinner (a la carte) will be served at 6:30 p. m. Those desiring to participate should notify H. R. Cobleigh, 505 Pearl street (telephone 4200 Worth), New York, before February 9, and are requested to meeting in the society's rooms at 6:15 p. m.

Air Brake Association.—The twenty-first annual convention of the Air Brake Association will be held at the Hotel Pontchartrain, Detroit, Mich., May 5-8, 1914. The subjects are as follows: Electro-Pneumatic Signal System for Passenger Trains, by L. N. Armstrong; Air Hose, by T. W. Dow; Clasp Type of Foundation Brake Gear for Heavy Passenger Equipment Cars, by T. L. Burton; Air Gage and Conductor's Valve in Caboose Cars, by Mark Purcell; Analysis of the Factors Involved in Controlling and Stopping Passenger Trains, by Walter V. Turner; 100 Per Cent Efficiency of Freight Train Brakes, by Fred von Bergen; Recommended Practice, S. G. Down, committee chairman; Topical Subjects, Mountain Grade Work, by H. H. Forney, and Modern Train Braking, by George W. Nolan. Among the entertainment features of the convention will be a "Manufacturers' Exploitation Meeting." One afternoon will be set aside for the members to assemble in the convention hall, where each exhibitor will be given from 15 to 30 minutes in which to exploit, by discourse, charts or lantern slides, or in any manner he chooses, the product or device which he desires to place before the assemblage. The executive committee inaugurates this convention novelty, believing that it will assist the booth exhibits, and also give the members an orderly account of what the exhibitors are contributing to the air brake art.

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting of mechanical associations.

AIR BRAKE ASSOCIATION.—F. M. Nellis, 53 State St., Boston, Mass. Convention, May 5-8, 1914, Detroit, Mich.

AMERICAN RAILWAY MASTER MECHANICS' ASSOC.—J. W. Taylor, Karpen building, Chicago. Convention, June 15-17, 1914, Atlantic City, N. J.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—A. R. Davis, Central of Georgia, Macon, Ga.

AMERICAN SOCIETY FOR TESTING MATERIALS.—Prof. E. Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth St., New York. Railroad session, February 10, 1914.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 841 North Fiftieth Court, Chicago; 2d Monday in month, Chicago.

CHIEF INTERCHANGE CAR INSPECTORS' AND CAR FOREMEN'S ASSOCIATION.—S. Skidmore, 946 Richmond street, Cincinnati, Ohio.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—C. G. Hall, 922 McCormick building, Chicago. Convention, May 18-22, 1914, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 829 W. Broadway, Winona, Minn. Convention, July 14-17, 1914, Hotel Sherman, Chicago.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—A. L. Woodworth, Lima, Ohio. Convention, August 18-20, 1914, Milwaukee, Wis.

MASTER BOILER MAKERS' ASSOCIATION.—Harry D. Vought, 95 Liberty St., New York. Convention, May 25-28, 1914, Philadelphia, Pa.

MASTER CAR BUILDERS' ASSOCIATION.—J. W. Taylor, Karpen building, Chicago. Convention, June 10-12, 1914, Atlantic City, N. J.

MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOC. OF U. S. AND CANADA.—A. P. Dane, B. & M., Reading, Mass.

RAILWAY STOREKEEPERS' ASSOCIATION.—J. P. Murphy, Box C, Collinwood, Ohio.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, N. Y. C. & H. R., East Buffalo, N. Y. Convention, August, 1914, Chicago, Ill.

RAILROAD CLUB MEETINGS

Club.	Next Meeting.	Title of Paper.	Author.	Secretary.	Address.
Canadian	Feb. 10	The College Man and the Railroads.....	J. S. Hall.....	Jas. Powell	Room 13, Windsor Hotel, Montreal.
Central	Mar. 12	Interchange Rules	H. M. Butts.....	H. D. Vought....	95 Liberty St., New York.
New England....	Feb. 10	Steel Passenger Car Construction.....	F. M. Brinkerhoff...	Wm. E. Cade....	683 Atlantic Ave., Boston, Mass.
New York	Feb. 20	Development in Railway Signal Glass.....	Wm. Churchill.....	H. D. Vought....	95 Liberty St., New York.
Pittsburgh	Feb. 27	Malleable Iron Pipe Fittings.....	J. C. Bannister.....	J. B. Anderson...	207 Penna. Station, Pittsburgh, Pa.
Richmond	Feb. 9	Wrought Iron vs. Steel Tubes.....	J. A. Kincaid.....	F. O. Robinson..	C. & O. Ry., Richmond, Va.
St. Louis	Feb. 13	.....	Slason Thompson....	B. W. Frauenthal.	Union Station, St. Louis, Mo.
Western	Feb. 17	.....	W. E. Dunham.....	Jos. W. Taylor...	1112 Karpen Bldg., Chicago.

PERSONALS

It is our desire to make these columns cover as completely as possible all the changes that take place in the mechanical departments of the railways of this country, and we shall greatly appreciate any assistance that our readers may give us in helping to bring this about.

GENERAL

E. B. HALL, division master mechanic of the Chicago & North Western at Chicago, has been appointed assistant to the general superintendent of motive power and car departments, with headquarters at Chicago.

ALONZO G. PACK, district inspector of locomotive boilers for the Interstate Commerce Commission at Denver, Col., has been appointed assistant chief inspector, with headquarters at Washington, D. C., succeeding Frank McManamy, promoted.

FRANK MCMANAMY has been appointed chief inspector of locomotive boilers for the Interstate Commerce Commission, with headquarters at Washington, D. C., succeeding J. F. Ensign, deceased.

J. W. SASSER, master mechanic of the Seaboard Air Line, at Jacksonville, Fla., has been appointed superintendent of motive power of the Norfolk Southern, with office at Norfolk, Va.

MASTER MECHANICS AND ROAD FOREMEN OF ENGINES

C. D. ASHMORE, general foreman of the Chicago & North Western at Clinton, Iowa, has been appointed master mechanic at Pekin, Ill., a newly created position.

WM. BAKER has been appointed road foreman of engines of the Lehigh Valley, with office at Wilkes-Barre, Pa.

J. A. BARKER has been appointed road foreman of engines of the Chesapeake & Ohio of Indiana, with office at Peru, Ind.

J. D. BELTZ has been appointed road foreman of engines of the Baltimore & Ohio at Pittsburgh, Pa.

JOHN BENZIES, supervisor of locomotive operation of the Missouri and Des Moines Valley divisions of the Rock Island Lines, with office at Chicago, has had his jurisdiction extended over the West Iowa division.

F. W. BOARDMAN has been appointed master mechanic of the Baltimore & Ohio at Eastside, Philadelphia, Pa., succeeding W. Sennott.

J. A. CASSADY has been appointed master mechanic of the Alabama Great Southern, with office at Birmingham, Ala.

B. F. CROWLEY has been appointed supervisor of locomotive operation of the Baltimore & Ohio, with headquarters at Wheeling, W. Va., succeeding T. B. Burgess.

W. A. CURLEY has been appointed master mechanic of the Missouri Pacific at Monroe, La., succeeding W. J. McKiernan.

F. S. DEVENY has been appointed road foreman of engines of the Baltimore & Ohio, with office at Chicago Junction, Ohio.

J. G. DOLE has been appointed master mechanic of the Alliance division of the Chicago, Burlington & Quincy, with headquarters at Alliance, Neb., succeeding T. J. Raycroft, resigned.

G. N. GAGE has been appointed assistant road foreman of engines of the Baltimore & Ohio, with headquarters at Rockwood, Pa.

E. J. GARRETT has been appointed road foreman of equipment of the Missouri & North Arkansas, with the additional duties of inspector of locomotive fuel performance, with office at Harrison, Ark.

J. I. KEIPER has been appointed road foreman of engines of the Lehigh Valley, with headquarters at South Easton, Pa., succeeding John Roney.

H. KUGLER has been appointed road foreman of engines of the Lehigh Valley, with office at Buffalo, N. Y.

WILLIAM LANON has been appointed supervisor of locomotive operation of the Arkansas, Indian Territory and Louisiana divisions of the Rock Island Lines, with headquarters at Little Rock, Ark., succeeding S. T. Patterson, transferred.

J. W. NEILL has been appointed district master mechanic of the Canadian Pacific at Moose Jaw, Sask., succeeding J. P. McAnany.

T. NICHOLSON has been appointed master mechanic of the Louisiana Railroad & Navigation Company at Shreveport, La., succeeding M. F. McCarra, resigned.

J. O'CONNOR, assistant master mechanic of the Staten Island Rapid Transit, and the Staten Island Railway at Clifton, Staten Island, N. Y., has been appointed master mechanic, with headquarters at Clifton, and his former position has been abolished.

H. H. PARKER has been appointed master mechanic of the Seaboard Air Line at Jacksonville, Fla.

S. T. PATTERSON has been appointed supervisor of locomotive operation of the Chicago Terminal, Illinois and East Iowa divisions of the Rock Island Lines at Chicago, Ill., succeeding R. E. Wallace.

B. POWERS has been appointed road foreman of engines of the Detroit, Toledo & Ironton, with office at Springfield, Ohio.

C. B. RANDALL has been appointed master mechanic of the Missouri Pacific, with headquarters at Van Buren, Ark., succeeding W. A. Curley.

EDWARD ROBERTSON has been appointed road foreman of equipment of the Arkansas division of the Rock Island Lines, with headquarters at Little Rock, Ark., succeeding H. L. Foster.

J. H. WATTERS, master mechanic of the Georgia Railroad at Augusta, Ga., has resigned after 43 years of continuous railway service, to devote his time to other work. A portrait of Mr. Watters and a sketch of his railway career were published in the Railway Age Gazette, Mechanical Edition, October, 1913, page 573. The position of master mechanic has been abolished.

F. W. WILSON has been appointed supervisor of locomotive operation of the Cedar Rapids, Minnesota and Dakota divisions of the Chicago, Rock Island & Pacific, with headquarters at Cedar Rapids, Iowa.

CAR DEPARTMENT

OSCAR ANDERSON has been appointed car foreman of the Great Northern at Skykomish, Wash., succeeding W. E. Johnston.

JOHN S. COOPER has been appointed car foreman of the Rock Island Lines at Hulbert, Ark., succeeding W. K. Smith.

F. H. EDMONDS has been appointed traveling car inspector of the Missouri Pacific, with office at Little Rock, Ark., succeeding C. F. Mase.

J. FLETCHER has been appointed car foreman of the Rock Island Lines at Armourdale, Kan., succeeding George McDonald.

E. W. HARTOUGH has been appointed car foreman of the Missouri, Kansas & Texas at St. Louis, Mo.

JOHN H. HAWKINS has been appointed car foreman of the Rock Island Lines at Pratt, Kan., succeeding C. R. McArthur.

G. F. HENNESSEY has been appointed general car and locomotive foreman of the Chicago, Milwaukee & St. Paul at Marion, Iowa.

W. C. LINDER has been appointed car foreman of the Pennsylvania Railroad at Shire Oaks, Pa., succeeding J. E. Ruff.

C. F. MASE has been appointed general foreman, car department, of the Missouri Pacific, with headquarters at Argenta, Ark.

C. R. McArthur has been appointed car foreman of the Rock Island Lines at St. Louis, Mo., succeeding J. Fletcher.

George McLean has been appointed car foreman of the Chicago Great Western at Oelwein, Iowa, succeeding W. R. Lutem.

F. T. Summers has been appointed general car foreman of the Baltimore & Ohio at Garrett, Ind., succeeding J. H. Agar.

SHOP AND ENGINE HOUSE

F. S. Anthony, mechanical superintendent of the Texas & Pacific at Marshall, Tex., has resigned.

L. E. Boline has been appointed foreman boilermaker of the Rock Island Lines at Pratt, Kan., succeeding J. W. Greenly.

Lee Chapman, division foreman of the Chicago & North Western at Norfolk, Neb., has been appointed division foreman at Chadron, Neb., succeeding W. H. Halsey, transferred.

J. P. Cooney has been appointed locomotive foreman of the Great Northern at Casselton, N. D., succeeding J. T. Murtinger.

William A. Cull has been appointed roundhouse foreman of the Atchison, Topeka & Santa Fe at Silsbee, Tex., succeeding F. J. Mannix.

A. J. Cunningham has been appointed foreman of the Atchison, Topeka & Santa Fe at Barstow, Cal.

C. R. Fryant has been appointed shop foreman of the Chicago & North Western at Wyeville, Wis., succeeding G. Schimming.

W. H. Halsey, division foreman of the Chicago & North Western at Chadron, Neb., has been appointed general foreman at Missouri Valley, Iowa, succeeding George H. Logan, promoted.

J. B. Haslet has been appointed locomotive foreman of the Great Northern at Breckenridge, Minn., succeeding William Krier.

Albert Lodor has been appointed foreman boilermaker of the Rock Island Lines at Biddle, Ark., succeeding P. J. Donohue.

George H. Logan, general foreman of the Chicago & North Western at Missouri Valley, Iowa, has been appointed general foreman at Clinton, Iowa, succeeding C. D. Ashmore, promoted.

J. W. McDonough has been appointed roundhouse foreman of the Erie, at Kent, Ohio, succeeding P. J. Gallagher.

R. S. Mennie has been appointed engineer of shop improvements of the Rock Island Lines, with headquarters at Chicago, succeeding W. J. Eddy, promoted.

J. Murphy, division foreman of the Chicago & North Western at Tremont, Neb., has been appointed division foreman at Norfolk, Neb., succeeding Lee Chapman, transferred.

T. Nash has been appointed general foreman of the Baltimore & Ohio at Holloway, Ohio, succeeding H. Ainscough.

S. Olson, general shop foreman of the Oregon Short Line at Ogden, Utah, has been transferred in that capacity to Pocatello, Idaho.

F. C. Simpson has been appointed general foreman of the Southern Railway at Asheville, N. C., succeeding E. L. Adams.

F. Stamelin, shop foreman of the Canadian Pacific at Winnipeg, Man., has been appointed night locomotive foreman at that point, succeeding J. Morton, transferred.

J. E. Stone has been appointed general foreman of the Oregon Short Line at Ogden, Utah.

H. Witte, roundhouse foreman of the Chicago & North Western at South Omaha, Neb., has been appointed division foreman at Tremont, Neb., succeeding J. Murphy, transferred.

Supply Trade Notes

C. H. Schlacks has been elected president of the Hale & Kilburn Company, Philadelphia, Pa.

John F. Schurch has been elected vice-president of the Damascus Brake Beam Company, Cleveland, Ohio.

Kelly R. Johnston, formerly with the National Malleable Castings Company, Cleveland, Ohio, has been appointed sales agent of the locomotive headlight department of the Remy Electric Company, Anderson, Ind.

A. Reiche, formerly general manager of the Orenstein Arthur Koppel Company's plant and general offices at Koppel, Pa., sailed for Germany, January 14, and has been succeeded by Erich Joseph, formerly New York manager of that company.

The Jerguson Manufacturing Company, Boston, Mass., has changed its name to the Wiltbonco Manufacturing Company. The company, which is engaged in the manufacture of Wiltbonco locomotive and boiler specialties, will remain at the same address and continue under the same management.

William Cooper, director of buildings and equipment at the East Pittsburgh works of the Westinghouse Electric & Manufacturing Company, died on January 23. Mr. Cooper was born near Watertown, N. Y., on November 24, 1861. He attended Cornell University and began in business with a cheese manufacturing firm, having charge of the power plant. At the age of 25 he went to Ottumwa, Ia., to engage in the building of automatic screw machines. Soon after he started a shop in Minneapolis for himself, undertaking the development of a compressed air traction system. He was thus led to the investigation of the hydraulic speed changing gear now manufactured by the Waterbury Tool Company, Waterbury, Conn., and used for moving the turrets on battleships. Mr. Cooper then entered the employ of the Twin City Rapid Transit Company, Minneapolis, being master mechanic and chief engineer for four years. In 1894 he went to the General Electric Company, and during his stay at Schenectady supervised the manufacture of the locomotives for the Baltimore & Ohio terminal at Baltimore, being detailed to put them into service after their erection. After the completion of this work he became associated with Blood & Hale, consulting engineers, Boston, Mass. On September 1, 1897, he entered the employ of the Bullock Electric & Manufacturing Company, Cincinnati, Ohio, and general superintendent in charge of engineering and manufacturing. In 1904 he entered the railway engineering department of the Westinghouse Electric & Manufacturing Company. His first work was to investigate the unit switch control, which the company was then exploiting. Following that he was appointed engineering inspector. He was also one of the members of the verification committee. Two years ago, when the works department was organized, he was made director of buildings and equipment. In addition to other work in the railway field he was active in the design and manufacture of the equipment fur-

W. Cooper

nished the several roads which have been electrified by the Westinghouse company.

The Pullman Company has announced the establishment of a pension plan providing for the retirement of employees at the age of 70, or after 20 years of service in case of disability, with a pension equal to 1 per cent for each year of service of the average rate of pay for the last year of service. No one over 45 years of age will be taken into service hereafter except by special arangement. The pension plan will be administered by a board of pensions, consisting of Richmond Dean, general manager, chairman; William Hough, auditor; Leroy Kramer, assistant to the president; L. S. Hungerford, general superintendent, and L. S. Taylor, treasurer. The company has about 33,000 employees.

The Franklin Railway Supply Company, New York, because of growth in business has been compelled to enlarge and reorganize its sales department. Walter H. Coyle has been elected second vice-president in charge of sales. William L. Allison will remain in charge of the company's office at Chicago as western sales manager. J. H. Steiger will continue in charge of sales on the Pacific coast, with office in San Francisco, as will also Pedro M. Armendariz in charge of sales in Mexico with office in Mexico City. Ralph G. Coburn has been promoted to eastern sales manager, and Alan Lichtenhein to Canadian sales manager, both with offices at 30 Church street, New York.

Walter H. Coyle

Walter H. Coyle was born at Salamanca, N. Y., December 27, 1878. Four years later his family removed to Meadville, Pa., and Mr. Coyle was educated in the public schools of that place. After leaving school he was for 11 years in the service of the Erie Railroad in various capacities in the mechanical and traffic departments. In January, 1905, he became identified with the Kent Manufacturing Company, Kent, Ohio, and in June of the same year entered the mechanical department of the Franklin Railway Supply Company, with headquarters at Franklin, Pa. In June, 1911, he was made assistant to the vice-president, with headquarters at New York, and was placed in charge of the sales department of the central territory, which position he held until his election as second vice-president, as noted above.

Ralph G. Coburn

Ralph G. Coburn, who has been appointed eastern sales manager, with headquarters at New York, was born at Boston in 1882. He graduated from Harvard in 1904, and entered the service of the American Glue Company. He remained with that company about four years, being in charge of its western factories and having his headquarters at Des Moines, Iowa, and Chicago. On May 1, 1909, he opened the Chicago office of the Franklin Railway Supply Company as resident sales manager. On June 1, 1911, he was made assistant to the vice-president, in charge of eastern-southern territory, with headquarters at New York, which position he held until his appointment as eastern sales manager.

Alan Lichtenhein

Alan Lichtenhein was born May 24, 1887, and is a graduate of both Williams College and the Harvard Law School. Upon the death of his father, who for many years occupied a very prominent position in the Canadian railway supply field, he entered the service of the Franklin Railway Supply Company in Canada, and now succeeds to his father's position in charge of Canadian sales of that company.

Elmer E. Allbee resigned from his position as mechanical superintendent of the Safety Car Heating & Lighting Company, New York, on January 1. Mr. Allbee graduated from the University of Vermont in 1889. He entered the employ of the Safety Car Heating & Lighting Company in 1890, and has held the position of mechanical engineer and mechanical superintendent for the last 11 years.

At the annual meeting of the directors of the American Arch Company, John P. Neff and William L. Allison were elected vice-presidents.

Mr. Neff was born at La Fontaine, Ind., May 2, 1874. In 1895 he was graduated from the mechanical engineering department of Purdue University and entered the service of the Chicago & North Western as a special apprentice. During the greater part of his special apprenticeship he was in charge of the locomotive testing plant where a very considerable amount of research work was being carried o.n Following this he served as a machinist; assistant roundhouse foreman at Chicago; division foreman of the motive power department at Waseca, Minn., October, 1899, to May, 1901; master mechanic at Huron, S. D., May, 1901, to September 1902; master mechanic of the Western Iowa division, with headquarters at Boone, Iowa, September, 1902, to July, 1904. In 1904 he left railroad service to take a position as engineer of tests

J. P. Neff

of the American Locomotive Equipment Company. In 1906 he was made mechanical engineer of that company, and succeeded to a similar position with the American Arch Company when it was formed in 1910. In March, 1912, he was made assistant to the president of the American Arch Company, which position he held until his recent election as vice-president.

W. L. Allison

William Locke Allison was born near Salisbury, N. C., March 20, 1876. He was educated at the Davis Military School, Winston-Salem, N. C., and received a United States Military Academy appointment, but did not graduate. He entered the government service as United States deputy marshal, which position he held for three and a half years. From March, 1898, to January, 1904, he was employed by the Baldwin Locomotive Works in various capacities, the last year of his service with that company being as engineer of tests. From January, 1904, to August, 1909, he was mechanical engineer of the Atchison, Topeka & Santa Fe, with headquarters at Chicago. In 1909 he became identified with the Franklin Railway Supply Company, and for two years was mechanical manager, with office at New York. Since that time he has been western sales manager, with office at Chicago, and has also been western sales manager of the Rome Merchant Iron Mills and the Economy Devices Corporation, and general western sales manager of the American Arch Company.

E. M. Chadwick, formerly with the Fairbanks Company, has been appointed manager of the Buffalo branch of Manning, Maxwell & Moore, New York. D. A. Hamilton, formerly with the Reed Prentice Company, of Worcester, has been appointed assistant at Manning, Maxwell & Moore's Detroit branch.

R. M. Campbell has been appointed special representative of the railway department in the eastern territory of the Detroit Graphite Company, Detroit, Mich., with headquarters at 135 Broadway, New York City. Mr. Campbell was for a number of years with the Ohio Brass Company and the Transportation Utilities Company.

B. S. McClellen, who for several years has had charge of the railway sales department of the McCord Manufacturing Company, Chicago, has resigned active connection with this company in order to give more personal attention to his other interests. A new company which he has just organized, the McClellen Nut Company, Chicago, will shortly place upon the market a one-piece self-locking nut, which will be known as the "Unit" lock nut, and which will do away with the use of the additional lock nut, thereby making possible the use of a shorter bolt. Mr. McClellen has had years of experience in the railway field, and is the inventor of over 30 improvements connected with car and locomotive work, many of which are standard on the largest systems in this country. He was for seven years general foreman of the New Orleans terminals of the Illinois Central in charge of both locomotive and car departments. He was at one time also general foreman of the passenger car department of the New York Central lines at West Albany, N. Y., and has been also master car builder of the Fort Worth & Denver City, Ft. Worth, Tex.

CATALOGS

Pipe Union.—A circular from the National Tube Company, Pittsburgh, Pa., presents the advantages of the Kewanee union in the form of an interview on the question and answer basis. It also illustrates in colors several designs of this type of union.

Motor Gears and Pinions.—Railway motor gears and pinions are fully illustrated and described in bulletin No. A-4199 from the General Electric Company, Schenectady, N. Y. This bulletin contains curves and data which will be of especial interest to the designers of equipment using motors.

Electricity in Iron Foundries.—Bulletin A-4167 from the General Electric Company, Schenectady, N. Y., is devoted to the subject of electricity in iron foundries, and is profusely illustrated with typical installations of motors in this department. A chapter is also given on foundry lighting.

Reamers.—Catalog No. 4 on cost cutting tools for machine shops prepared by the McCrosky Reamer Company, Meadville, Pa., contains 59 pages devoted to an illustrated discussion of adjustable reamers, quick change chucks and collets, variable speed and reversing attachments especially suitable for drilling machines, expanding mandrels, universal lamp brackets for lighting machine tools, combination face-plates and dogs.

Speed Recorder with Clock Attachment.—Bulletin No. 166 from the Chicago Pneumatic Tool Company, Fisher building, Chicago, fully describes the latest improvement to the Boyer speed recorder which consists of the addition of a clock attachment so arranged as to record graphically the time at all points during the trip. This addition does not in any way affect the remainder of the machine. The chart from the new recorder then allows the following information to be obtained: speed in miles per hour, total mileage, actual running time between any and all points, total time on the road, time and location of each stop or slow-down, time consumed by each stop, time and location of each brake application, acceleration, rate of increase or decrease in speed between any two points. The catalog includes a sample section of the new chart.

Car Lighting Fixtures.—In compiling its car lighting catalog No. 166, the Dayton Manufacturing Company, Dayton, Ohio, has endeavored to illustrate and enumerate so far as practicable all the fixtures which its experience indicates to be needed for the efficient and artistic illumination of modern steam and electric railway cars. This catalog takes the form of a 158 page, cloth bound book with pages 9 in. x 12 in. The value of having good illustrations for a catalog of this nature has been fully appreciated and the book is given up very largely to views of the fixtures. Descriptive matter is included wherever necessary and a short section is devoted to a discussion of electric car lighting in general, with wiring diagrams. A type of shade holder that has been giving very excellent results in the saving of glassware and time is also described.

Mechanical Belt Shifter.—Under the title of "Safety-Commercialized," R. K. LeBlond Machine Tool Company, Cincinnati, Ohio, has prepared a leaflet devoted to a discussion of the danger of personal injury from the usual method of shifting a belt on machine tools and also to an illustrated description of a mechanical belt shifter which has been perfected by it. This shifter can be applied to belt driven machine tools of any kind or make. The principle on which it operates is a mechanically operated shifter for both the cone head on the machine and the one on the countershaft. These two are so connected that one operates in advance of the other, both being moved by a handle on the head of the machine. The shifter is said to be positive and rapid in its operation and to increase the life of the belt. The catalog is thoroughly illustrated.